

# TUTOR'S ASSISTANT;

BEING A

## COMPENDIUM OF ARITHMETIC,

AND

## A COMPLETE QUESTION-BOOK.

CONTAINING,

I. ARITHMETIC in WHOLE NUMBERS; being a brief Explanation of all its Rules, in a New and more concise Method than any hitherto published; with an Application to each Rule, consisting of a large Variety of Questions in real Business, with their Answers annexed.

II. VULGAR FRACTIONS, which are treated with a great deal of Plainness and Perspicuity,

III. DECIMALS, with the Extraction of the Square, Cube, and Biquadrate Roots, after a very plain and familiar Manner;

in which are set down Rules for the easy Calculation of Interest, Annuities, and Pensions in Arrear, the present Worth of Annuities, &c. either by Simple or Compound Interest.

IV. DUODECIMALS, or MULTIPLICATION of Feet and Inches, with Examples applied to measuring and working by Multiplication, Practice, and Decimals.

V. The MENSURATION of CIRCLES,

VI. A COLLECTION of QUESTIONS set down promiscuously, for the greater Trial of the foregoing Rules,

To which are added,

*A new and very short Method of extracting the CUBE-ROOT, and a GENERAL TABLE for the ready calculating the INTEREST of any Sum of Money, at any Rate per Cent. likewise Rents, Salaries, &c.*

The whole being adapted either as a QUESTION-BOOK for the Use of Schools, or as a REMEMBRANCER and INSTRUCTOR to such as have some Knowledge therein.

This Work having been perused by several eminent Mathematicians and Accomptants, is recommended as the best Compendium hitherto published for the Use of Schools, or for private Persons.

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By FRANCIS WALKINGAME.

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A NEW EDITION.

CORRECTED, AND EVERY QUESTION WORKED ANEW,

By T. CROSBY,

HEAD-MASTER OF THE CHARITY-SCHOOL, YORK.

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YORK:

Printed by and for T. WILSON and R. SPENCE, in High-Overgate.

Anno 1800.





## Advertisement.

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THE necessity for books of this nature to be correct, has induced the Publishers to engage Mr. CROSBY, of York, to work every question anew. The many errors which had crept into the former editions are here expunged; and the Editors may with confidence announce the present to be the best edition that has yet appeared of "The Tutor's Assistant."

For the use and ease of Schoolmasters, and those who wish to instruct themselves, the above Gentleman has compiled a KEY to this work, lately published; in which every sum is properly stated and worked in full. This will undoubtedly prove very acceptable to Teachers in general; as by referring to the Key, they will find a proper statement of the account given, which will save the master the great trouble of going over every figure when the scholar presents him with his work; and in order to find the solution the more readily, REFERENCE FIGURES are placed at the beginning of each question in this new edition of Walkinghame.

YORK, OCTOBER 26, 1800.

## PREFACE.

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HAVING some time ago drawn up a set of rules and proper questions, with their answers annexed, for the use of my own school, and divided them into several books, as well for more ease to myself, as the readier improvement of my scholars, I found them, by experience, of infinite use: for when a master takes upon him that laborious (though unnecessary) method of writing out the rules and questions in the children's books, he must either be toiling and slaving himself, after the toil of the school is over, to get ready the books for the next day, or else he must lose that time which would be much better spent in instructing and opening the minds of his pupils. There was, however, still an inconvenience which hindered them from giving me the satisfaction I at first expected, *i. e.* where there are several boys in a class, some one or other must wait till the boy who first has the book finishes the writing out those rules and questions he wants, which detains the others from making that progress they otherwise might, had they a proper book of rules and examples for each; to remedy which, I was prompted to compile one, in order to have it printed, that it might not only be of use to my own school, but to such others as would have their scholars make a quick progress. It will also be of great use to such gentlemen as have acquired some knowledge of numbers at school, to make them the more perfect; likewise to such as have completed themselves therein, it will prove, after an impartial perusal, on account of its great variety and brevity, a most agreeable and entertaining exercise-book. I shall not presume to say any thing more in favour of this work, but beg leave to refer the unprejudiced reader to the remark of a certain author\*, concerning compositions of this nature. His words are as follow:

“ And now, after all, it is impossible that some who  
“ like best to tread the old beaten path, and to sweat  
“ at

## PREFACE.

" at their business, when they may do it with pleasure,  
 " may start an objection against the use of this well-in-  
 " tended ASSISTANT, because the course of ARITHME-  
 " TIC is always the same; and therefore say, *That some*  
 " *boys, lazily inclined, when they see another at work upon*  
 " *the same question, will be apt to make his operation pass for*  
 " *their own.* But these little forgeries are soon detected  
 " by the diligence of the TUTOR: Therefore, as diffe-  
 " rent questions to different boys do not in the least pro-  
 " mote their improvement, so neither do the questions  
 " hinder it. Neither is it in the power of any master, (in  
 " the course of his business) how full of spirits soever he  
 " be, to frame new questions at pleasure, in any rule; but  
 " the same question will frequently occur in the same rule,  
 " notwithstanding his greatest care and skill to the con-  
 " trary.

" It may also be further objected, *That to teach by a*  
 " *printed book, is an argument of ignorance and incapacity;*  
 " which is no less trifling than the former. He, indeed,  
 " (if any such there be) who is afraid his scholars will im-  
 " prove too fast, will undoubtedly decry this method:  
 " But that master's ignorance can never be brought in  
 " question who can begin and end it readily; and most  
 " certainly, that scholar's none-improvement can be as  
 " little questioned, who makes a much greater progress by  
 " this than by the common method."

To enter into a long detail of every rule would tire the  
 reader, and swell the preface to an unusual length; I shall,  
 therefore, only give a general idea of the method of pro-  
 ceeding, and leave the rest to speak for itself; which, I  
 hope, the kind reader will find to answer the title, and the  
 recommendation given it. As to the rules, they follow  
 in the same manner as the table of contents specifies, and  
 much in the same order as they are generally taught in  
 schools. I have gone through the four fundamental rules  
 in Integers first, before those of the several Denominations,  
 in order that they being well understood, the latter will  
 be performed with much more ease and despatch, accord-  
 ing to the rules shown, than by the customary method of  
 dotting. In Multiplication I have shown both the beauty  
 and use of that excellent rule, in resolving most questions  
 that occur in merchandizing, and have prefixed before

Reduction, several bills of parcels, which are applicable to real business. In working Interest by Decimals, I have added tables to the rules, for the readier calculating annuities, &c. and have not only shown the use, but the method of making them. I have also added to this *Edition*, a NEW RULE for extracting the *Cube Root*, being a much shorter way than already published; as likewise an Interest-table, calculated for easier finding the interest of any sum of money, at any rate *per cent.* by Multiplication and Addition only: It is also useful in calculating rents, incomes, and servants' wages, for any number of months, weeks, or days; and I may venture to say, I have gone through the whole with so much plainness and perspicuity, that there is none better extant.

I have nothing further to add, but a return of my sincere thanks to all those Gentlemen, Schoolmasters, and others, whose kind approbation and encouragement have now established the use of this book in almost every school of eminence throughout the kingdom; but I think my gratitude more especially due to those who have favoured me with their remarks; though I must still beg of every candid and judicious reader, that if he should, by chance, find a transposition of a letter, or a false figure, to excuse it; for, notwithstanding there has been great care taken in correcting, yet errors of the press will inevitably creep in; and some may also have slipped my observation; in either of which cases, the admonition of a good-natured reader will be very acceptable to his

*much obliged*

*and most obedient*

*humble Servant,*

**F. WALKINGAME,**



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# EXPLANATION

## OF THE

### CHARACTERS made Use of in this COMPENDIUM.

- $=$  *Equal.* The Sign of Equality; as, 4 qrs.  $=$  1 cwt. signifies, that 4 qrs. are equal to 1 cwt.
- $-$  *Minus or less.* The Sign of Subtraction; as,  $8-2=6$ ; that is, 8 lessened by 2 is equal to 6.
- $+$  *Plus or more.* The Sign of Addition; as,  $4+4=8$ ; that is, 4 added to 4 more is equal to 8.
- $\times$  *Multiplied by.* The Sign of Multiplication; as,  $4 \times 6=24$ ; that is, 4 multiplied by 6 is equal to 24.
- $\div$  *Divided by.* The Sign of Division; as,  $8 \div 2=4$ ; that is, 8 divided by 2 is equal to 4.
- $\frac{2537}{63}$  Numbers placed like a fraction, do likewise denote Division; the upper number being the dividend, and the lower the divisor.
- $\therefore$  *is, :: So is.* The Sign of Proportion; as,  $2:4::8:16$  that is, as 2 is to 4 so is 8 to 16.
- $\overline{7-2}+5=10$  Shows that the difference between 2 and 7, added to 5 is equal to 10.
- $9-\overline{2+5}=2$  Signifies, that the sum of 2 and 5 taken from 9 is equal to 2.
- $\sqrt{\quad}$  Prefixed to any number, signifies the Square Root of that number is required.
- $\sqrt[3]{\quad}$  Signifies the Cube, or third power.
- $\sqrt[4]{\quad}$  Denotes the Biquadrate, or the fourth power, &c.
- i.e.* *id. est,* that is.



THE  
TUTOR'S ASSISTANT;  
BEING A  
COMPENDIUM OF ARITHMETIC, &c.

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PART I.

ARITHMETIC IN WHOLE NUMBERS.

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THE INTRODUCTION.

ARITHMETIC is the art or science of computing by numbers, and consists both in theory and practice.

The *theory* considers the nature and quality of numbers, and demonstrates the reason of practical operations.

The *practice* is that which shows the method of working by numbers, so as to be the most useful and expeditious for business, and has five principal or fundamental rules for the operations, *viz.*

NOTATION OF NUMERATION, ADDITION, SUBTRACTION, MULTIPLICATION, and DIVISION.

NUMERATION

TEACHETH the different value of figures by their different places, and to read and write any sum or number.

C Millions.			C Thousands.			Hundreds.		
X	Millions.		X	Thousands.		Tens.	Units.	
9	8	7	6	5	4	3	2	1
9	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0
			6	0	0	0	0	0
			5	0	0	0	0	0
			4	0	0	0	0	0
						3	0	0
						2	0	
							1	

**RULE.** There are three periods; the first on the right hand, units; the second, thousands; and the third, millions; each consisting of three figures or places. Reckon the first figure of each, from the left hand, as so many hundreds, the next as tens, and the third as so many single ones of what is written over them: as the first period on the left-hand is read thus, nine hundred and eighty-seven millions; and so on for any of the rest.

*The APPLICATION.*

*Write down in proper figures the following numbers.*

- (<sup>1</sup>) Twenty-three.
- (<sup>2</sup>) Two hundred and fifty-four.
- (<sup>3</sup>) Three thousand, two hundred and four
- (<sup>4</sup>) Twenty-five thousand, eight hundred fifty-six.
- (<sup>5</sup>) One hundred thirty-two thousand, two hundred forty-five.
- (<sup>6</sup>) Four millions, nine hundred forty-one thousand, four hundred.
- (<sup>7</sup>) Twenty-seven millions, one hundred fifty-seven thousand, eight hundred thirty two.
- (<sup>8</sup>) Seven hundred twenty-two millions, two hundred thirty-one thousand, five hundred four.
- (<sup>9</sup>) Six hundred two millions, two hundred ten thousand, five hundred,

\* The superior figures placed between parenthesis, refer to the Key, in which the solution will be found.

Write down in words at length the following numbers.

5<sup>(13)</sup> 2016<sup>(16)</sup> 519007<sup>(19)</sup> 5204054<sup>(22)</sup> 65700047<sup>(25)</sup>  
 9<sup>(14)</sup> 5201<sup>(17)</sup> 750058<sup>(20)</sup> 2071909<sup>(23)</sup> 90006157<sup>(26)</sup>  
 2<sup>(15)</sup> 20760<sup>(18)</sup> 5900030<sup>(21)</sup> 70054008<sup>(24)</sup> 201900790<sup>(27)</sup>

## Notation by ROMAN Letters.

One.	XXX.	Thirty.
Two.	XL.	Forty.
Three.	L.	Fifty.
Four.	LX.	Sixty.
Five.	LXX.	Seventy.
Six.	LXXX.	Eighty.
Seven.	XC.	Ninety.
Eight.	C.	Hundred.
Nine.	CC.	Two hundred.
Ten.	CCC.	Three hundred.
Eleven.	CCCC.	Four hundred.
Twelve.	D.	Five hundred.
Thirteen.	DC.	Six hundred.
Fourteen.	DCC.	Seven hundred.
Fifteen.	DCCC.	Eight hundred.
Sixteen.	DCCCC.	Nine hundred.
Seventeen.	M.	One thousand.
Eighteen.	M,DCCCI.	One thousand
Nineteen.		eight hundred and one.
Twenty.		

## ADDITION OF INTEGERS

**ACHETH** to add two or more sums together, to one whole or total sum.

**ULE.** There must be due regard had in placing the one under the other, *i. e.* units under units, tens under tens, &c. then beginning with the first row of units, add them up to the top; when done, set down the units, carry the tens to the next, and so on; continuing to the last row, at which set down the total amount.

**PROOF.** Begin at the top of the sum, and reckon the same downwards, the same as you add them up, and, if the same as the first, the sum is supposed to be right.

B

ADDITION

C Millions.	X Millions.	M Millions.	C Thousands.	X Thousands.	T Thousands.	Hundreds.	Tens.	Units.
9	8	7	6	5	4	3	2	1
9	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0

**RULE.** There are three periods; the first on the right hand, units; the second, thousands; and the third, millions; each consisting of three figures or places. Reckon the figure of each, from the left hand, as so many hundreds the next as tens, and the third as so many single ones; what is written over them: as the first period on the right hand is read thus, nine hundred and eighty-seven millions; and so on for any of the rest.

*The APPLICATION.*

*Write down in proper figures the following numbers.*

- (<sup>1</sup>) Twenty-three.
- (<sup>2</sup>) Two hundred and fifty-four.
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- (<sup>5</sup>) One hundred thirty-two thousand, two hundred forty-five.
- (<sup>6</sup>) Four millions, nine hundred forty-one thousand four hundred.
- (<sup>7</sup>) Twenty-seven millions, one hundred fifty-seven thousand, eight hundred thirty two.
- (<sup>8</sup>) Seven hundred twenty-two millions, two hundred thirty-one thousand, five hundred four.
- (<sup>9</sup>) Six hundred two millions, two hundred ten thousand five hundred.

\* The superior figures placed between parenthesis, refer to the Key, in which solution will be found.



*Write down in words at length the following numbers.*

(<sup>10</sup>) 35 (<sup>13</sup>) 2016 (<sup>16</sup>) 519007 (<sup>19</sup>) 5204054 (<sup>22</sup>) 65700047  
 (<sup>11</sup>) 59 (<sup>14</sup>) 5201 (<sup>17</sup>) 750058 (<sup>20</sup>) 2071909 (<sup>23</sup>) 90006157  
 (<sup>12</sup>) 172 (<sup>15</sup>) 20760 (<sup>18</sup>) 5900030 (<sup>21</sup>) 70054008 (<sup>24</sup>) 201900790

*Notation by ROMAN Letters.*

I.	One.	XXX.	Thirty.
II.	Two.	XL.	Forty.
III.	Three.	L.	Fifty.
IV.	Four.	LX.	Sixty.
V.	Five.	LXX.	Seventy.
VI.	Six.	LXXX.	Eighty.
VII.	Seven.	XC.	Ninety.
VIII.	Eight.	C.	Hundred.
IX.	Nine.	CC.	Two hundred.
X.	Ten.	CCC.	Three hundred.
XI.	Eleven.	CCCC.	Four hundred.
XII.	Twelve.	D.	Five hundred.
XIII.	Thirteen.	DC.	Six hundred.
XIV.	Fourteen.	DCC.	Seven hundred.
XV.	Fifteen.	DCCC.	Eight hundred.
XVI.	Sixteen.	DCCCC.	Nine hundred.
XVII.	Seventeen.	M.	One thousand.
XVIII.	Eighteen.	M, DCCCI.	One thousand
XIX.	Nineteen.		eight hundred and one.
XX.	Twenty.		

## ADDITION OF INTEGERS

**TEACHETH** to add two or more sums together, to make one whole or total sum.

**RULE.** There must be due regard had in placing the figures one under the other, *i. e.* units under units, tens under tens, &c. then beginning with the first row of units, add them up to the top; when done, set down the units, and carry the tens to the next, and so on; continuing to the last row, at which set down the total amount.

**PROOF.** Begin at the top of the sum, and reckon the figure downwards, the same as you add them up, and, if the same as the first, the sum is supposed to be right.

B

ADDITION

## ADDITION AND SUBTRACTION TABLE.

1	2	3	4	5	6	7	8	9
2	4	5	6	7	8	9	10	11
3	5	6	7	8	9	10	11	12
4	6	7	8	9	10	11	12	13
5	7	8	9	10	11	12	13	14
6	8	9	10	11	12	13	14	15
7	9	10	11	12	13	14	15	16
8	10	11	12	13	14	15	16	17
9	11	12	13	14	15	16	17	18

£.	Cwt.	Qrs.	Months.	£.	Years.
( <sup>1</sup> ) 2	( <sup>2</sup> ) 27	( <sup>3</sup> ) 276	( <sup>4</sup> ) 1234	( <sup>5</sup> ) 7524	( <sup>6</sup> ) 27104
5	35	110	7098	3750	32547
7	47	473	3314	9147	10758
9	35	354	6732	3215	62590
2	41	271	2546	4725	75408
5	39	352	3709	2147	27973
4	56	471	4152	3254	85421
3	37	310	3705	2716	12706
7	14	437	1076	1047	10471
<u>44</u>	<u>331</u>	<u>      </u>	<u>      </u>	<u>      </u>	<u>      </u>

## SUBTRACTION OF INTEGERS

**TEACHETH** to take a less number from a greater, and shows the remainder or difference.

**RULE.** This being the reverse of Addition, you must borrow here (if it requires) what you stopped at there, always remembering to pay it to the next.

**PROOF.** Add the remainder and less line together, and if the same as the greater, it is right.

	£.	Hund.	Hours.	Weeks.	Hbds.	Minutes.
From ( <sup>1</sup> )	271	( <sup>2</sup> ) 4754	( <sup>3</sup> ) 42087	( <sup>4</sup> ) 432705	( <sup>5</sup> ) 271508	( <sup>6</sup> ) 3750214
Take	154	2725	34096	327616	152741	2150173
	<u>      </u>	<u>      </u>	<u>      </u>	<u>      </u>	<u>      </u>	<u>      </u>
Rem.	117	—	—	—	—	—
	<u>      </u>	<u>      </u>	<u>      </u>	<u>      </u>	<u>      </u>	<u>      </u>
Proof	271	<u>      </u>	<u>      </u>	<u>      </u>	<u>      </u>	<u>      </u>

MULTI-

# MULTIPLICATION OF INTEGERS

**TEACHETH** how to increase the greater of two numbers given, as often as there are units in the less; and compendiously performs the office of many additions.

To this rule belong three principal members, *viz.*

1. The multiplicand, or number to be multiplied:
2. The multiplier, or number by which you multiply.
3. The product, or number produced by multiplying.

**RULE.** Begin with that figure that stands in the unit's place of the multiplier, and with it multiply the first figure in the unit's place of the multiplicand. Set down the units, and carry the tens in mind till you have multiplied the next figure in the multiplicand by the same figure in the multiplier; to the product of which add the tens you kept in mind, setting down the units, and proceed as before, till the whole line is multiplied.

**PROOF.** The usual way of proving multiplication is, by casting out the nines from the multiplicand and multiplier; the remainders put on each side of a cross; multiply the figures on each side together, cast out the nines from the product, and put the overplus at top; then cast out the nines from the product of the multiplication, and its remainder place at the bottom; if it agree with the top, the work is supposed right; but the surest way is to divide the product by the multiplicand, and the quotient will be the same as the multiplier.

## MULTIPLICATION and DIVISION TABLE.

1	2	3	4	5	6	7	8	9	10	11	12
2	4	6	8	10	12	14	16	18	20	22	24
3	6	9	12	15	18	21	24	27	30	33	36
4	8	12	16	20	24	28	32	36	40	44	48
5	10	15	20	25	30	35	40	45	50	55	60
6	12	18	24	30	36	42	48	54	60	66	72
7	14	21	28	35	42	49	56	63	70	77	84
8	16	24	32	40	48	56	64	72	80	88	96
9	18	27	36	45	54	63	72	81	90	99	108
10	20	30	40	50	60	70	80	90	100	110	120
11	22	33	44	55	66	77	88	99	110	121	132
12	24	36	48	60	72	84	96	108	120	132	144

*Multiplication of Integers.*

*Multiplicand* <sup>(1)</sup> 25104736 <sup>(2)</sup> 52471021 <sup>(3)</sup> 7925437521  
*Multiplier* 2 3 4

*Product* 50209472  
<sup>(4)</sup> 27104107 <sup>(5)</sup> 231037 <sup>(6)</sup> 7062526 <sup>(7)</sup> 3723104  
 5 6 7 8

<sup>(8)</sup> 4214406 <sup>(9)</sup> 2701047 <sup>(10)</sup> 31040171 <sup>(11)</sup> 35210472  
 9 10 11 12

When the multiplier is more than 12, and less than 20, multiply by the unit figure in the multiplier, adding to the product the back figure to that you multiplied.

<sup>(12)</sup> 4710572 <sup>(13)</sup> 5107252 <sup>(14)</sup> 6653210 <sup>(15)</sup> 92057165  
 13 14 15 16

<sup>(16)</sup> 6251721 <sup>(17)</sup> 9215324 <sup>(18)</sup> 2571341 <sup>(19)</sup> 3592104  
 17 18 19 19

When the multiplier consists of several figures, there must be as many products as there are figures in the multiplier, observing to put the first figure of every product under that figure you multiply by. Add the several products together, and their sum will be the total produce.

o <sup>(20)</sup> 271041 <sup>(21)</sup> 32104 <sup>(22)</sup> 2710432 <sup>(23)</sup> 27501976  
 6+o 27 25 375 271  
 o  
 1897287 802600 1016412000 7453035496  
 54282  
 7318107

When cyphers are placed between the significant figures in the multiplier, they may be united; but great care must be taken that the next figure be put one place more to the left-hand, *i. e.* under the figure you multiply by

<sup>(24)</sup> 571204



( <sup>24</sup> ) 571204 27009	( <sup>25</sup> ) 7104325 57020	( <sup>26</sup> ) 5271094 590030
<u>15427648836</u>	<u>405088611500</u>	<u>3110103592820</u>

When there are cyphers at the end of the multiplicand, or multiplier, they may be omitted, by only multiplying by the rest of the figures, and setting down on the right-hand of the total product as many cyphers as were omitted.

( <sup>27</sup> ) 27100 52600	( <sup>28</sup> ) 379500 274000	( <sup>29</sup> ) 265000 7200	( <sup>30</sup> ) 574000 630
<u>1425460000</u>	<u>103983000000</u>	<u>1908000000</u>	<u>361620000</u>

When the multiplier is a composite number, *i. e.* if any two figures being multiplied together will make that number, then multiply by one of those figures, and that product by the other will give the answer.

(<sup>31</sup>) 771039 by 35. (<sup>32</sup>) 921563 by 32. (<sup>33</sup>) 715241 by 56.

<u>26986365</u>	<u>29490016</u>	<u>40053496</u>
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## DIVISION OF INTEGERS

**T**EACHETH to find how often one number is contained in another, or to divide any number into what parts you please.

In this rule there are three numbers real, and a fourth accidental, *viz.*

1. The dividend, or number to be divided:
2. The divisor, or number by which you divide.
3. The quotient, or number that shows how often the divisor is contained in the dividend:

4th, or accidental number, is what remains when the work is finished, and is of the same name as the dividend.

**RULE.** When the divisor is less than 12, find how often it is contained in the first figure of the dividend, set it down under the figure you divided, and carry the overplus (if any) to the next in the dividend, as so many tens. then find how often the divisor is contained therein, set it down, and continue the same till you have gone through

the line; but when the divisor is more than 12, multiply it by the quotient figure; the product subtract from the dividend, and to the remainder bring down the next figure in the dividend, and proceed as before, till the figures are all brought down.

PROOF. Multiply the divisor and quotient together, adding the remainder (if any), and the product will be the same as the dividend.

*Divid. Rem.*

Divisor (1)	2	725107(1	(2)	3	721472(	(3)	4	7210416(
Quotient		362553						
		<u>2</u>						
Proof		725107	(4)	5	7203287(	(5)	6	5231037(
		<u></u>						

(6)	7	2332701(	(7)	8	2547325(	(8)	9	25048306(
		<u></u>						

(9)	10	2750012(	(10)	11	2710513(	(11)	12	27100732(
		<u></u>						

*Divis. Divid. Quot.*

(12)	29	4172377	(143)	875
	29			29

			(13)	37	7210473(194877
--	--	--	------	----	----------------

127	1294875	(14)	473	2104721(4449
116	287750			

	2 Rem.	(15)	275	3720147(13527
--	--------	------	-----	---------------

.112	4172377	Proof	(16)	3701	72109521(19483
------	---------	-------	------	------	----------------

87		(17)	3576	72104725(20163
----	--	------	------	----------------

.253		(18)	2510	63210476(25183
------	--	------	------	----------------

232		(19)	25204	321047217(12737
-----	--	------	-------	-----------------

.217		(20)	31709	521047321(16432
------	--	------	-------	-----------------

203		(21)	2701234	7210472532(2669
-----	--	------	---------	-----------------

.147		(22)	210472	352107193214(1671990
------	--	------	--------	----------------------

145		(23)	3721071	21071921473(560
-----	--	------	---------	-----------------

Rem. . . 2

When

When there are cyphers at the end of the divisor, they may be cut off, and as many places from off the dividend, but must be annexed to the remainder at last.

(<sup>24</sup>) 271|00) 254732| 21(939    (<sup>25</sup>) 5721|00) 7253472| 16(1267

(<sup>26</sup>) 373|000) 752473| 719(2017    (<sup>27</sup>) 215|000) 6325104| 297(29419

When the divisor is a composite numbr, (*i.e.* if any two figures being multiplied together, will make that number) then by dividing the dividend by one of those figures, and that quotient by the other, it will give the quotient required. But as it sometimes happens, that there is a remainder to each of the quotients, and neither of them the true one, it may be found by this

**RULE.** Multiply the first divisor into the last remainder, so that product add the first remainder, which will give the true one.

(<sup>29</sup>)                      (<sup>30</sup>)                      (<sup>30</sup>)                      (<sup>31</sup>)  
Div. 3210473 by 27. 7210473 by 35. 6251043 by 42. 5761034 by 54.

118906. 11 R.    206013. 18 R.    148834. 15 R.    106685. 44 R.

Marked

MONEY.

Marked

$\frac{1}{4}$  Farthing                      4 Farthings make 1 Penny - d.  
 $\frac{1}{2}$  Halfpenny                      12 Pence — 1 Shilling - s.  
 $\frac{3}{4}$  Three Farthings                      20 Shillings — 1 Pound - £.

4 Farthings = 1 Penny  
48 = 12 = 1 Shilling.  
960 = 240 = 20 = 1 Pound.

SHILLINGS.

PENCE TABLE.

s.	£.	s.	d.	s.	d.	d.	s.	d.
20	} is	1 : 0	20	} is	1 : 8	90	} is	7 : 6
30		1 : 10	24		2 : 0	96		8 : 0
40		2 : 0	30		2 : 6	100		8 : 4
50		2 : 10	36		3 : 0	108		9 : 0
60		3 : 0	40		3 : 4	110		9 : 2
70		3 : 10	48		4 : 0	120		10 : 0
80		4 : 0	50		4 : 2	130		10 : 10
90		4 : 10	60		5 : 0	132		11 : 0
100		5 : 0	70		5 : 10	140		11 : 8
110		5 : 10	72		6 : 0	144		12 : 0
120		6 : 0	80		6 : 8	150		12 : 6
130		6 : 10	84		7 : 0	160		13 : 4

TROY

## Tables of Weights.

## TROY WEIGHT.

Marked.

24 Grains	make	1 Pennyweight	} <i>gr.</i> <i>dwt.</i> <i>oz.</i> <i>lb.</i>
20 Pennyweights	—	1 Ounce	
12 Ounces	—	1 Pound	

Grains.

24 =	1 Pennyweight.
480 = 20 =	1 Ounce.
5760 = 240 = 12 =	1 Pound.

By this weight are weighed gold, silver, jewels, electuaries and all liquors.

☞ The standard for gold coin is 22 carats of fine gold, and 2 carats of copper melted together. For silver is 11 *oz.* 2 *dwt.* of fine silver, 18 *dwt.* of copper.

25 *lb.* is a quarter of an *cwt.* 100 *lb.* 1 *cwt.*

20 *cwt.* 1 ton of gold or silver.

## AVOIRDUFOISE WEIGHT

Marked.

16 Drams	make	1 Ounce	} <i>dr.</i> <i>oz.</i> <i>lb.</i> <i>qr.</i> <i>cwt.</i> <i>ton.</i>
16 Ounces	—	1 Pound	
28 Pounds	—	1 Quarter	
4 Quarters, or 112 <i>lb.</i>		1 Hundred weight	
20 Hundred weight		1 Ton	

Drams.

16 =	1 Ounce.
256 = 16 =	1 Pound.
7168 = 448 = 28 =	1 Quarter.
28672 = 1792 = 112 = 4 =	1 Cwt.
573440 = 35840 = 2240 = 80 = 20 =	1 Ton.

There are several other denominations in this weight, that are used in some particular goods, *viz.*

	<i>lb.</i>		<i>lb.</i>
A firkin of Butter	56	A stone of Iron shot,	} 14
Soap	64	or horseman's wt.	
A barrel of Anchovies	30	A stone of butcher's meat	8
Soap	256	A gallon of Train-oil	7½
Raisins	112	A truss of Straw	36
A Puncheon of Prunes	112	new Hay	60
A fother of lead, 19 <i>cwt.</i>		old Hay	56
2 <i>qrs.</i>		36 Trusses a load.	

CHEESE



CHEESE AND BUTTER.

A clove, or half-stone, 8 *lb.*

A wey in Suffolk, {	<i>lb.</i>	A wey in Essex, {	<i>lb.</i>
32 cloves, or {	256	42 cloves, or {	336

WOOL.

A clove	-	-	7	A wey is 6 tod and {	<i>lb.</i>
A stone	-	-	14	1 stone, or {	182
A tod	-	-	28	A sack is 2 weys, or	364
				A last is 12 sacks, or	4368

By this weight is weighed any thing of a coarse or drossy nature, as all groceries or chandlery wares; bread, and all metals, but silver and gold.

NOTE. 1 pound Avoirdupoise is equal to 14 oz. 11 dwts. 15½ grs. Troy.

APOTHECARIES' WEIGHT.

					<i>Marked.</i>
20 Grains	make	1 Scruple	-	-	℥
3 Scruples	—	1 Dram	-	-	ʒ
8 Drams	—	1 Ounce	-	-	℥
12 Ounces	—	1 Pound	-	-	℔

Grains.

20 = 1 Scruple.

60 = 3 = 1 Dram.

480 = 24 = 8 = 1 Ounce.

5760 = 288 = 96 = 12 = 1 Pound.

Note. The Apothecaries mix their medicines by this rule, but buy and sell their commodities by Avoirdupoise weight.

The Apothecaries' pound and ounce, and the pound and ounce Troy are the same, only differently divided and subdivided.

CLOTH MEASURE.

					<i>Marked.</i>
4 Nails	make	1 Quarter of a Yard.	{	<i>n.</i>	
3 Quarters	—	1 Flemish ell	-	<i>qrs.</i>	F. E.
4 Quarters	—	1 Yard	-		yd.
5 Quarters	—	1 English ell	-		E. E.
6 Quarters	—	1 French ell	-		Fr. E.
					Inches.

## Tables of Measure.

## Inches.

$2\frac{1}{4}$	=	1 Nail.
9	=	4 = 1 Quarter.
36	=	16 = 4 = 1 Yard.
27	=	12 = 3 = 1 Flemish ell.
45	=	20 = 5 = 1 English ell.

## LONG MEASURE.

				Marked.
3 Barley corns	make	1 Inch		$\left\{ \begin{array}{l} \text{bar.} \\ \text{in.} \end{array} \right.$
12 Inches	—	1 Foot	—	feet.
3 Feet	—	1 Yard	—	yd.
6 Feet	—	1 Fathom	—	fth.
$5\frac{1}{2}$ Yards	—	1 Rod, Pole, or Perch	—	rod. p.
40 Poles	—	1 Furlong	—	fur.
8 Furlongs	—	1 Mile	—	mile.
3 Miles	—	1 League	—	leag.
60 Miles	—	1 Degree	—	deg.

## Barley corns.

3	=	1 Inch.
36	=	12 = 1 Foot.
108	=	36 = 3 = 1 Yard.
594	=	198 = $16\frac{1}{2}$ = $5\frac{1}{2}$ = 1 Pole.
23760	=	7920 = 660 = 220 = 40 = 1 Furlong.
190080	=	63360 = 5280 = 1760 = 320 = 8 = 1 Mile.

A degree is 69 miles, 4 furlongs nearly, though commonly reckoned but 60 miles.

This measure is used to measure distance of places, or any thing else that has length only.

## WINE MEASURE.

				Marked.
2 Pints	make	1 Quart		$\left\{ \begin{array}{l} \text{pts.} \\ \text{qts.} \end{array} \right.$
4 Quarts	—	1 Gallon	—	gal.
10 Gallons	—	1 Anker of Brandy	—	ank.
18 Gallons	—	1 Runlet	—	run.
$31\frac{1}{2}$ Gallons	—	Half a Hoghead	—	$\frac{1}{2}$ hhd.
42 Gallons	—	1 Tierce	—	tierce.
63 Gallons	—	1 Hoghead	—	hhd.
2 Hogheads	—	1 Pipe or butt	—	p or butt.
2 Pipes, or 4 hogheads	—	1 Tun	—	tun.
				Cubic

Cubic inches.

$$28\frac{1}{2} = 1 \text{ Pint.}$$

$$57\frac{1}{4} = 2 = 1 \text{ Quart.}$$

$$231 = 8 = 4 = 1 \text{ Gallon.}$$

$$9702 = 336 = 168 = 42 = 1 \text{ Tierce.}$$

$$14553 = 504 = 252 = 63 = 1\frac{1}{2} = 1 \text{ Hoghead.}^1$$

$$19404 = 672 = 336 = 84 = 2 = 1\frac{1}{4} = 1 \text{ Punch.}$$

$$29106 = 1008 = 504 = 126 = 3 = 2 = 1\frac{1}{2} = 1 \text{ Pipe.}$$

$$58212 = 2016 = 1008 = 252 = 6 = 4 = 3 = 2 = 1 \text{ Tun.}$$

All brandies, spirits, perry, cyder, mead, vinegar, honey, and oil are measured by this measure; as also milk, not by law, but custom only.

ALE AND BEER MEASURE.

Marked.

2 Pints	make	1 Quart	{ pts. qts.
4 Quarts	—	1 Gallon	gal.
8 Gallons	—	1 Firkin of ale	A. fir.
9 Gallons	—	1 Firkin of beer	B. fir.
2 Firkins	—	1 Kilderkin	kil.
4 Firkins, or 2 kilderkins	—	1 Barrel	bar.
1 Barrel and $\frac{1}{2}$ or 54 gal.	—	1 Hoghead of Beer	bhd.
2 Barrels	—	1 Puncheon	pun.
3 Barrels, or 2 hogheads	—	1 Butt	buts.

BEER.

Cubic inches.

$$35\frac{1}{4} = 1 \text{ Pint.}$$

$$70\frac{1}{2} = 2 = 1 \text{ Quart.}$$

$$282 = 8 = 4 = 1 \text{ Gallon.}$$

$$2538 = 72 = 36 = 4 = 1 \text{ Firkin.}$$

$$5076 = 144 = 72 = 18 = 2 = 1 \text{ Kilderkin.}$$

$$10152 = 288 = 144 = 36 = 4 = 2 = 1 \text{ Barrel.}$$

$$15228 = 432 = 216 = 54 = 6 = 3 = 1\frac{1}{2} = 1 \text{ Hoghead}$$

$$20304 = 576 = 288 = 72 = 8 = 4 = 2 = 1 \text{ Puncheon,}$$

$$30456 = 864 = 432 = 108 = 12 = 6 = 3 = 2 = 1 \text{ Butt.}$$

ALE.

Cubic inches.

$$35\frac{1}{4} = 1 \text{ Pint.}$$

$$70\frac{1}{2} = 1 \text{ Quart.}$$

$$282 = 8 = 4 = 1 \text{ Gallon.}$$

$$2256 = 64 = 32 = 8 = 1 \text{ Firkin.}$$

$$4512 = 128 = 64 = 16 = 2 = 1 \text{ Kilderkin.}$$

$$9024 = 256 = 128 = 32 = 4 = 2 = 1 \text{ Barrel.}$$

$$13530 = 384 = 192 = 48 = 6 = 3 = 1\frac{1}{2} = 1 \text{ Hoghead}$$

In London they compute but 8 gallons to the firkin of ale and 32 to the barrel; but in all other parts of England, for ale, strong beer, and small, 34 gallons to the barrel, and  $8\frac{1}{2}$  gallons to the firkin.

A barrel of salmon or eels is 42 gallons.

A barrel of herrings 32 gallons.

A keg of sturgeon 4 or 5 gallons.

A firkin of soap 8 gallons.

### DRY MEASURE.

				Marked.
2 Pints	make	1 Quart		{ pts. qts.
2 Quarts	—	1 Pottle	—	pot.
2 Pottles	—	1 Gallon	—	gal.
2 Gallons	—	1 Peck	—	pk.
4 Pecks	—	1 Bushel	—	bush.
2 Bushels	—	1 Strike	—	strike
4 Bushels	—	1 Coom	—	coom.
2 Cooms, or 8 Bushels	—	1 Quarter	—	qr.
4 Quarters	—	1 Chaldron	—	chal.
5 Quarters	—	1 Wey	—	wey.
2 Weys	—	1 Last	—	last.

In London 36 bushels make a chaldron.

Solid inches

$268\frac{1}{2} = 1$  Gallon.

$537 = 2 = 1$  Peck.

$2150 = 8 = 4 = 1$  Bushel.

$4300 = 16 = 8 = 2 = 1$  Strike.

$8601 = 32 = 16 = 4 = 2 = 1$  Coom.

$17203 = 64 = 32 = 8 = 4 = 2 = 1$  Quarter.

$86016 = 320 = 160 = 40 = 20 = 10 = 5 = 1$  Wey.

$172032 = 640 = 320 = 80 = 40 = 20 = 10 = 2 = 1$  Last.

The bushel in *Water Measure* is 5 pecks.

A score of coals is 21 Chaldron.

A sack of coals 3 Bushels.

A Chaldron of coals 12 Sacks.

A load of corn 5 Bushels.

A cart load ditto 40 Bushels.

This measure is applied to all dry goods.

The standard bushel is  $18\frac{1}{2}$  inches wide, and 8 inches deep.



TIME.

Marked

60 Seconds	make	1 Minute	} " m. hour. day. week. mo. yr.
60 Minutes	—	1 Hour	
24 Hours	—	1 Day	
7 Days	—	1 Week	
4 Weeks	—	1 Month	
13 Months, 1 day, 6 hours,		1 Julian year	

Seconds.

60 = 1 Minute.

3600 = 60 = 1 Hour.

86400 = 1440 = 24 = 1 Day.

604800 = 10080 = 168 = 7 = 1 Week

2419200 = 40320 = 672 = 28 = 4 = 1 Month.

d. h. w. d. h.

31557600 = 525960 = 8766 = 365:3 = 52:1:6 = 1 Julian yr.

d. h. m. "

31556937 = 525948 = 8765 = 365:4:48:57 = 1 Solar year.

To know the days in each month observe:

Thirty days hath September,  
April, June, and November;  
February hath twenty-eight alone,  
All the rest hath thirty and one;  
Except in Leap year, and then's the time,  
February's days are twenty and nine.

SQUARE MEASURE.

144 Inches	make	1 Foot.
9 Feet	—	1 Yard.
100 Feet	—	1 Square of flooring.
272½ Feet	—	1 Rod.
40 Rods	—	1 Rood.
4 Roods, or 160 rods, or 4840 yards		1 Acre of land.
640 Acres	—	1 Square Mile.
30 Acres	—	1 Yard of land.
100 Acres	—	1 Hide of land.

C

Inches.

Inches.

144 = 1 Foot.

1296 = 9 = 1 Yard.

39204 = 272  $\frac{1}{4}$  = 30  $\frac{1}{4}$  = 1 Pole.

1568160 = 10890 = 1210 = 40 = 1 Rood.

6272640 = 43560 = 4840 = 160 = 4 = 1 Acre.

By this measure are measured all things that have length and breadth; such as land, painting, plaistering, flooring, thatching, plumbing, glazing, &c.

## SOLID MEASURE.

1728 Inches make 1 Solid Foot.

27 Feet = 1 Yard, or load of earth.

Or, 40 Feet of round timber, } is 1 ton or load.  
50 Feet of hewn timber, }

108 solid feet, *i. e.* 12 feet in length, 3 feet in breadth, and 3 deep; or, commonly, 14 feet long, 3 feet 1 inch broad, and 3 feet 1 inch is a stack of wood.

128 solid feet, *i. e.* 8 feet long, 4 feet broad, and 4 feet deep, is a cord of wood.

By this measure are measured all things that have length, breadth, and depth.

## ADDITION of MONEY, WEIGHTS, and MEASURES.

**R**ULE. Add the first row or denomination together, as in Integers; then divide the sum by as many of the same denomination as make one of the next greater, setting down the remainder under the row added, and carry the quotient to the next superior denomination, continuing the same to the last, which add as in Simple Addition.

£.	s.	d.	£.	s.	d.	£.	s.	d.	£.	s.	d.
( <sup>1</sup> ) 2	13	5 $\frac{1}{2}$	( <sup>2</sup> ) 27	7	2	( <sup>3</sup> ) 35	17	3	( <sup>4</sup> ) 75	3	7
7	9	4 $\frac{1}{4}$	34	14	7 $\frac{1}{4}$	59	14	7 $\frac{1}{2}$	54	17	1 $\frac{1}{2}$
5	15	4 $\frac{1}{2}$	57	19	2 $\frac{1}{4}$	97	13	5 $\frac{1}{4}$	91	15	4 $\frac{1}{4}$
9	17	6 $\frac{1}{4}$	91	16	1	37	16	8 $\frac{1}{4}$	35	16	5 $\frac{1}{4}$
7	16	3	75	18	7 $\frac{3}{4}$	97	15	7	29	19	7 $\frac{1}{4}$
5	14	7 $\frac{3}{4}$	97	13	5	59	16	5 $\frac{1}{2}$	91	17	3 $\frac{1}{4}$
<hr/>			<hr/>			<hr/>			<hr/>		
39	6	7 $\frac{1}{4}$									

MONEY.

## MONEY.

£.	s.	d.	£.	s.	d.	£.	s.	d.	£.	s.	d.
( <sup>5</sup> ) 257	1	5 $\frac{1}{2}$	( <sup>6</sup> ) 525	2	4 $\frac{1}{4}$	( <sup>7</sup> ) 21	14	7 $\frac{1}{4}$	( <sup>8</sup> ) 73	2	1 $\frac{1}{2}$
734	3	7 $\frac{3}{4}$	179	3	5	75	16	0	25	12	7
595	5	3	250	4	7 $\frac{1}{4}$	79	2	4 $\frac{1}{4}$	96	13	5 $\frac{1}{2}$
159	14	7 $\frac{1}{2}$	975	3	5 $\frac{1}{4}$	57	16	5 $\frac{1}{4}$	76	17	3 $\frac{1}{4}$
207	5	4	254	5	7	26	13	8 $\frac{3}{4}$	97	14	1
798	16	7 $\frac{1}{4}$	379	4	5 $\frac{3}{4}$	54	2	7	54	11	7 $\frac{3}{4}$
<hr/> <hr/>			<hr/> <hr/>			<hr/> <hr/>			<hr/> <hr/>		
( <sup>9</sup> ) 127	4	7 $\frac{1}{2}$	( <sup>10</sup> ) 261	17	1 $\frac{1}{4}$	( <sup>11</sup> ) 31	1	1 $\frac{1}{2}$	( <sup>12</sup> ) 27	13	5
525	3	5	379	13	5	75	13	1	16	12	9 $\frac{1}{4}$
271	—	5	257	16	7 $\frac{3}{4}$	39	19	7 $\frac{1}{4}$	9	13	3
524	9	1	184	13	5	97	17	3 $\frac{1}{4}$	15	2	7 $\frac{1}{2}$
379	4	2 $\frac{1}{2}$	725	2	3 $\frac{1}{4}$	36	13	5	37	19	0
215	5	8 $\frac{3}{4}$	359	6	5	24	16	3 $\frac{1}{4}$	56	19	1 $\frac{3}{4}$
<hr/> <hr/>			<hr/> <hr/>			<hr/> <hr/>			<hr/> <hr/>		

## TROY WEIGHT.

oz.	dwt.	gr.	oz.	dwt.	gr.	lb.	oz.	dwt.	lb.	oz.	dwt.
( <sup>1</sup> ) 7	15	21	( <sup>2</sup> ) 5	11	4	( <sup>3</sup> ) 7	1	2	( <sup>4</sup> ) 5	2	15
3	17	6	7	19	21	3	2	7	13	11	17
2	5	15	3	15	14	5	1	5	13	7	15
3	16	19	7	19	22	2	7	3	13	9	7
9	18	23	9	18	15	7	10	1	19	1	13
7	15	14	8	13	12	3	11	7	15	2	15
<hr/> <hr/>			<hr/> <hr/>			<hr/> <hr/>			<hr/> <hr/>		

## AVOIRDUPOISE WEIGHT.

lb.	oz.	dr.	lb.	oz.	dr.	cwt.	qrs.	lb.	T. cwt.	qrs.	
( <sup>1</sup> ) 152	15	15	( <sup>2</sup> ) 17	12	3	( <sup>3</sup> ) 25	1	17	( <sup>4</sup> ) 7	17	2
272	14	10	23	15	6	72	3	26	5	5	3
353	15	11	31	11	14	54	1	16	2	4	1
255	10	4	97	—	9	24	1	16	3	18	2
173	6	2	48	7	15	17	—	19	7	9	3
635	13	13	79	10	6	55	2	16	8	5	1
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## APOTHECARIES' WEIGHT.

$\overset{3}{\text{lb}}$	$\overset{\text{O}}{\text{oz}}$	$\overset{\text{gr.}}{\text{gr.}}$	$\overset{3}{\text{lb}}$	$\overset{\text{O}}{\text{oz}}$	$\overset{\text{gr.}}{\text{gr.}}$	$\overset{\text{lb}}{\text{lb}}$	$\overset{\text{O}}{\text{oz}}$	$\overset{\text{gr.}}{\text{gr.}}$	$\overset{\text{lb}}{\text{lb}}$	$\overset{\text{O}}{\text{oz}}$	$\overset{\text{gr.}}{\text{gr.}}$
( <sup>1</sup> )7	0	17	( <sup>2</sup> )9	2	—	( <sup>3</sup> )7	10	7	( <sup>4</sup> )7	2	1
3	1	18	3	5	2	9	5	2	3	1	7
6	2	16	9	2	1	7	11	1	9	10	2
5	1	15	3	5	—	9	5	6	7	5	7
7	—	18	7	7	2	7	10	5	3	9	5
3	1	9	3	3	—	9	—	7	7	1	4
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## CLOTH MEASURE.

$\overset{\text{F.E.}}{\text{F.E.}}$	$\overset{\text{qrs.}}{\text{qrs.}}$	$\overset{\text{n.}}{\text{n.}}$	$\overset{\text{yds.}}{\text{yds.}}$	$\overset{\text{qrs.}}{\text{qrs.}}$	$\overset{\text{n.}}{\text{n.}}$	$\overset{\text{yds.}}{\text{yds.}}$	$\overset{\text{qrs.}}{\text{qrs.}}$	$\overset{\text{n.}}{\text{n.}}$	$\overset{\text{E.E.}}{\text{E.E.}}$	$\overset{\text{qrs.}}{\text{qrs.}}$	$\overset{\text{n.}}{\text{n.}}$
( <sup>1</sup> )27	2	1	( <sup>2</sup> )35	3	3	( <sup>3</sup> )73	3	2	( <sup>4</sup> )71	2	1
15	1	3	70	2	2	97	1	3	52	1	2
37	—	2	95	3	—	54	—	2	79	—	1
52	2	3	76	1	3	76	2	—	56	2	—
76	2	1	26	—	1	59	1	3	79	3	1
97	1	3	79	2	1	76	2	2	54	2	1
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## LONG MEASURE.

$\overset{\text{Feet}}{\text{Feet}}$	$\overset{\text{in.}}{\text{in.}}$	$\overset{\text{bar.}}{\text{bar.}}$	$\overset{\text{yds.}}{\text{yds.}}$	$\overset{\text{feet.}}{\text{feet.}}$	$\overset{\text{in.}}{\text{in.}}$	$\overset{\text{m.}}{\text{m.}}$	$\overset{\text{fur.}}{\text{fur.}}$	$\overset{\text{p.}}{\text{p.}}$	$\overset{\text{lea.}}{\text{lea.}}$	$\overset{\text{m.}}{\text{m.}}$	$\overset{\text{fur.}}{\text{fur.}}$
( <sup>1</sup> )27	1	2	( <sup>2</sup> )25	1	9	( <sup>3</sup> )35	7	3	( <sup>4</sup> )72	2	1
35	10	1	71	—	3	27	5	27	27	1	7
17	2	0	52	2	3	52	—	35	53	2	5
35	11	1	97	—	10	97	1	17	79	—	6
97	2	2	54	2	7	56	7	18	51	1	6
54	8	1	37	1	4	91	5	27	72	—	5
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## LAND MEASURE.

$\overset{\text{a.}}{\text{a.}}$	$\overset{\text{r.}}{\text{r.}}$	$\overset{\text{p.}}{\text{p.}}$	$\overset{\text{a.}}{\text{a.}}$	$\overset{\text{r.}}{\text{r.}}$	$\overset{\text{p.}}{\text{p.}}$	$\overset{\text{a.}}{\text{a.}}$	$\overset{\text{r.}}{\text{r.}}$	$\overset{\text{p.}}{\text{p.}}$	$\overset{\text{a.}}{\text{a.}}$	$\overset{\text{r.}}{\text{r.}}$	$\overset{\text{p.}}{\text{p.}}$
( <sup>1</sup> )75	3	27	( <sup>2</sup> )27	1	35	( <sup>3</sup> )26	1	31	( <sup>4</sup> )32	1	14
36	2	15	29	2	19	19	2	17	27	—	19
97	1	16	3	1	15	55	3	14	31	2	15
35	2	15	95	2	27	79	1	21	19	1	18
27	1	14	62	—	13	95	2	14	59	2	17
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## WINE MEASURE.

<i>run. gal. qts.</i>	<i>tier. gal. qts.</i>	<i>bbds. gal. qts.</i>	<i>T. bhd. gal.</i>
( <sup>1</sup> ) 27 17 2	( <sup>2</sup> ) 25 36 2	( <sup>3</sup> ) 31 57 1	( <sup>4</sup> ) 14 3 27
35 15 3	75 41 2	97 18 2	19 2 56
56 14 1	62 15 1	76 13 1	17 - 39
97 10 3	94 13 2	55 46 2	75 2 16
12 15 -	15 24 3	87 38 3	54 1 19
79 3 1	19 16 1	55 17 1	97 3 54
<u><u>          </u></u>	<u><u>          </u></u>	<u><u>          </u></u>	<u><u>          </u></u>

## ALE and BEER MEASURE.

<i>A.B. fir. gal.</i>	<i>B.B. fir. gal.</i>	<i>bhd. gal. qts.</i>	<i>bhd. gal. qt.</i>
( <sup>1</sup> ) 25 2 7	( <sup>2</sup> ) 37 2 8	( <sup>3</sup> ) 76 51 2	( <sup>4</sup> ) 76 2 1
17 3 5	54 1 7	57 3 3	95 35 2
96 2 6	97 3 8	97 27 3	57 16 3
75 1 4	78 2 5	22 17 3	22 14 1
96 3 7	47 - 7	32 19 3	32 37 3
75 - 5	35 2 5	55 38 -	55 16 1
<u><u>          </u></u>	<u><u>          </u></u>	<u><u>          </u></u>	<u><u>          </u></u>

## DRY MEASURE.

<i>qr. bu. p.</i>	<i>qr. bu. p.</i>	<i>ch. bu. p.</i>	<i>ch. bu. p.</i>
( <sup>1</sup> ) 75 7 2	( <sup>2</sup> ) 36 2 1	( <sup>3</sup> ) 75 27 2	( <sup>4</sup> ) 73 2 1
36 2 3	71 - 3	57 3 1	41 24 1
51 2 -	53 6 -	95 25 3	92 16 1
79 7 1	82 4 1	76 35 2	70 13 2
55 - 3	95 3 3	97 25 2	54 17 3
96 2 1	78 2 1	75 16 3	79 25 1
<u><u>          </u></u>	<u><u>          </u></u>	<u><u>          </u></u>	<u><u>          </u></u>

## TIME.

<i>h. m. "</i>	<i>d. h. m.</i>	<i>av. d. h.</i>	<i>av. d. h.</i>
( <sup>1</sup> ) 52 57 35	( <sup>2</sup> ) 72 23 26	( <sup>3</sup> ) 71 3 11	( <sup>4</sup> ) 57 2 15
97 16 27	54 14 35	51 2 9	95 3 21
16 51 54	97 12 31	76 - 21	76 - 15
96 18 31	58 21 45	95 3 21	53 2 21
75 34 21	96 20 48	79 1 15	98 2 18
<u><u>          </u></u>	<u><u>          </u></u>	<u><u>          </u></u>	<u><u>          </u></u>

## THE APPLICATION.

(<sup>1</sup>) A man born in the year 1750, when will he be 47 years of age? *Ans.* 1797.

(<sup>2</sup>) A, B, C, D, went partners in the purchase of a quantity of goods; A laid out 7*l.* half-a-guinea and a crown; B 4*9s.*; C 54*s.* 6*d.* and D 87*d.*—what was laid out in all? *Ans.* £ 13 : 6 : 3.

(<sup>3</sup>) A man lent his friend at different times these several sums, *viz.* 63*l.*; 25*l.* 15*s.*; 32*l.* 7*s.*; 15*l.* 14*s.* 10*d.*; and fourscore and nineteen pounds, half a guinea and a shilling. How much did he lend in all? *Ans.* £ 236 : 8 : 4.

(<sup>4</sup>) What is the estate worth *per annum*, when the taxes are 21 guineas, the neat income 8 score and 19*l.* 14*s.*

*Ans.* £ 201 : 15*s.*

(<sup>5</sup>) There are three numbers; the first 215, the second 519, and the third is as much as the other two—what is the sum of them all? *Ans.* 1468.

(<sup>6</sup>) Bought a parcel of goods, for which I paid 54*l.* 17*s.* for packing 13*s.* 8*d.*; carriage 1*l.* 5*s.* 4*d.*; and spent about the bargain 14*s.* 3*d.*—what do these goods stand me in?

*Ans.* £ 57 : 10 : 3.

(<sup>7</sup>) There are two numbers, the least whereof is 40, their difference 14—I desire to know what is the greater number, and the sum of both? *Ans.* 54 greater number, 94 sum.

(<sup>8</sup>) A gentleman left his eldest daughter 1500*l.* more than the youngest, and her fortune was 11 thousand 11 hundred and 11*l.*—what was the eldest sister's fortune, and what did the father leave them?

*Ans.* Eldest sister's fortune £ 13611. Father left them £ 35722.

(<sup>9</sup>) A nobleman, before he went out of town was desirous of paying all his tradesmen's bills, and upon inquiry he found that he owed 82 guineas for rent; to his wine-merchant 72*l.* 5*s.*; to his confectioner 12*l.* 13*s.* 4*d.*; to his draper 47*l.* 13*s.* 2*d.*; to his tailor 110*l.* 15*s.* 6*d.*; to his coach-maker 157*l.* 18*s.*; to his tallow-chandler 8*l.* 17*s.* 9*d.*; to his corn-chandler 170*l.* 6*s.* 8*d.*; to his brewer 52*l.* 17*s.*; to his butcher 122*l.* 11*s.* 5*d.*; to his baker 37*l.* 9*s.* 5*d.*; and to his servants for wages 53*l.* 18*s.*—I desire to know what money he had to raise in the whole, when we add to the above sums 100*l.* which he wished to take with him? *Ans.* £ 1033 : 7 : 3.

(10) A father was 24 years of age (allowing 13 months to a year, and 28 days to a month) when his first child was born; between the eldest and the next born was 1 year, 11 months, and 14 days; between the second and third were 2 years, 1 month, and 15 days; between the third and fourth were two years, 10 months, and 25 days; when the fourth was 27 years, 9 months, and 12 days old, how old was the father?

*Ans.* 58 years, 7 months, 10 days.

(11) A banker's clerk having been out with his bills brings home an account, that A paid him 7*l.* 5*s.* 2*d.* B 15*l.* 18*s.* 6½*d.* C 150*l.* 13*s.* 2¼*d.* D 17*l.* 6*s.* 8*d.* E 5 guineas, 2 crown pieces, 4 half-crowns, and 4*s.* 2*d.* F paid him only 20 groats, G 76*l.* 15*s.* 9½*d.* and H 12*l.* 12*s.* 4*d.*—I desire to know how much the whole amounted to that he had to pay?

*Ans.* £396 : 7 : 6½.

(12) A nobleman had a service of plate, which consisted of twenty dishes weighing 203 *oz.* 8 *dwt.*s.; 36 plates weighing 408 *oz.* 9 *dwt.*s.; 5 dozen of spoons, weighing 112 *oz.* 8 *dwt.*s.; 6 salts and 6 pepper boxes, weighing 71 *oz.* 7 *dwt.*s.; knives and forks, weighing 73 *oz.* 5 *dwt.*s.; 2 large cups, a tankard and mug, weighing 121 *oz.* 4 *dwt.*s.; a tea-kettle and lamp, weighing 131 *oz.* 7 *dwt.*s.; together with sundry other small articles, weighing 185 *oz.* 5 *dwt.*s.—I desire to know the weight of the whole?

*Ans.* 106 *lb.* 10 *oz.* 13 *dwt.*s.

(13) A hop merchant buys 5 bags of hops, of which the first weighed 2 *cwt.* 3 *qrs.* 13 *lb.*; the second 2 *cwt.* 2 *qrs.* 11 *lb.*; the third 2 *cwt.* 3 *qrs.* 5 *lb.*; the fourth 2 *cwt.* 3 *qrs.* 12 *lb.*; the fifth 2 *cwt.* 3 *qrs.* 15 *lb.* Besides these, he purchased two pockets, each weighing 84 *lb.*—I desire to know the weight of the whole?

*Ans.* 15 *cwt.* 2 *qrs.*

(14) A, of Vienna, owes to B, of Liverpool, for goods received in January, the sum of 103*l.* 12*s.* 2*d.*; for goods received in February 93*l.* 3*s.* 4*d.*; for goods received in March 121*l.* 17*s.*; for goods received in April 142*l.* 15*s.* 4*d.*; for goods received in May 171*l.* 15*s.* 10*d.*; for goods received in June 142*l.* 12*s.* 6*d.* but the latter six months of the year, owing to the falling off in the demands for the articles in which he dealt, amounted to the sum only of 205*l.* 7*s.* 2*d.*—I desire to know the amount of the whole year's bills?

*Ans.* £981 : 3 : 4.

SUBTRACTION

## SUBTRACTION of MONEY, WEIGHTS, and MEASURES.

**RULE.** Subtract as in Integers, only when any of the lower denominations are greater than the upper, borrow as many of that as make one of the next superior, adding it to the upper, from which take the less; set down the difference, and carry 1 to the next higher denomination for what you borrowed.

**PROOF.** As in Integers.

## MONEY.

(<sup>1</sup>) Borrowed  $\begin{array}{r} \text{£.} \quad \text{s.} \quad \text{d.} \\ 715 \quad 2 \quad 7\frac{1}{4} \\ \text{Paid} \quad 476 \quad 3 \quad 8\frac{1}{2} \end{array}$

(<sup>2</sup>) Lent  $\begin{array}{r} \text{£.} \quad \text{s.} \quad \text{d.} \\ 316 \quad 3 \quad 5\frac{1}{2} \\ \text{Received} \quad 218 \quad 2 \quad 1\frac{3}{4} \end{array}$

Remains to pay  $238 : 18 : 10\frac{3}{4}$

Proof  $715 : 2 : 7\frac{1}{4}$

$\begin{array}{r} \text{£.} \quad \text{s.} \quad \text{d.} \\ (3) 87 \quad 2 \quad 10 \\ 79 \quad 3 \quad 7\frac{1}{4} \end{array}$  (<sup>4</sup>)  $\begin{array}{r} \text{£.} \quad \text{s.} \quad \text{d.} \\ 3 \quad 15 \quad 1\frac{1}{2} \\ 1 \quad 14 \quad 7 \end{array}$  (<sup>5</sup>)  $\begin{array}{r} \text{£.} \quad \text{s.} \quad \text{d.} \\ 25 \quad 2 \quad 5\frac{1}{4} \\ 17 \quad 9 \quad 8\frac{1}{2} \end{array}$  (<sup>6</sup>)  $\begin{array}{r} \text{£.} \quad \text{s.} \quad \text{d.} \\ 37 \quad 3 \quad 4\frac{1}{4} \\ 27 \quad 5 \quad 2\frac{1}{4} \end{array}$

(<sup>7</sup>)  $\begin{array}{r} \text{£.} \quad \text{s.} \quad \text{d.} \\ 321 \quad 17 \quad 1\frac{1}{2} \\ 257 \quad 14 \quad 7 \end{array}$  (<sup>8</sup>)  $\begin{array}{r} \text{£.} \quad \text{s.} \quad \text{d.} \\ 59 \quad 15 \quad 3\frac{1}{2} \\ 36 \quad 17 \quad 2 \end{array}$  (<sup>9</sup>)  $\begin{array}{r} \text{£.} \quad \text{s.} \quad \text{d.} \\ 71 \quad 2 \quad 4 \\ 19 \quad 13 \quad 7\frac{1}{4} \end{array}$  (<sup>10</sup>)  $\begin{array}{r} \text{£.} \quad \text{s.} \quad \text{d.} \\ 527 \quad 3 \quad 5\frac{1}{4} \\ 139 \quad 5 \quad 7\frac{1}{2} \end{array}$

(<sup>11</sup>) Borrowed  $25107 \quad 15 \quad 7$  (<sup>12</sup>) Lent  $25156 \quad 1 \quad 6$

$\begin{array}{r} \text{Paid} \quad 375 \quad 5 \quad 5\frac{1}{4} \\ \text{at} \quad 259 \quad 2 \quad 7\frac{1}{2} \\ \text{different} \quad 359 \quad 13 \quad 4\frac{3}{4} \\ \text{times.} \quad 523 \quad 17 \quad 3 \\ 274 \quad 15 \quad 7\frac{1}{4} \\ 425 \quad 13 \quad 5 \end{array}$

$\begin{array}{r} 271 \quad 13 \quad 7\frac{1}{4} \\ \text{Received} \quad 359 \quad 15 \quad 3 \\ \text{at} \quad 475 \quad 13 \quad 9\frac{3}{4} \\ \text{several} \quad 527 \quad 15 \quad 3\frac{3}{4} \\ \text{payments} \quad 272 \quad 16 \quad 5 \\ 150 \quad - \quad - \end{array}$

Paid in all

Remains to pay

## TROY WEIGHT.

$\begin{array}{r} \text{oz.} \quad \text{dt.} \quad \text{gr.} \\ (1) \text{ Bought} \quad 27 \quad 15 \quad 2 \\ \text{Sold} \quad 21 \quad 14 \quad 7 \end{array}$  (<sup>2</sup>)  $\begin{array}{r} \text{oz.} \quad \text{dt.} \quad \text{gr.} \\ 7 \quad 5 \quad 15 \\ 6 \quad 7 \quad 14 \end{array}$  (<sup>3</sup>)  $\begin{array}{r} \text{lb.} \quad \text{oz.} \quad \text{dt.} \quad \text{gr.} \\ 52 \quad 1 \quad 7 \quad 2 \\ 39 \quad - \quad 15 \quad 7 \end{array}$  (<sup>4</sup>)  $\begin{array}{r} \text{lb.} \quad \text{oz.} \quad \text{dt.} \quad \text{gr.} \\ 7 \quad 2 \quad 2 \quad 5 \\ 5 \quad 7 \quad 1 \quad 7 \end{array}$

Unfold



## AVOIRDUPOISE WEIGHT.

lb.	oz.	dr.	lb.	oz.	dr.	cwt.	qrs.	lb.	T.	cwt.	qrs.	lb.
( <sup>1</sup> )25	11	15	( <sup>2</sup> )35	10	5	( <sup>3</sup> )35	1	21	( <sup>4</sup> )21	1	2	7
17	9	13	29	12	7	25	1	10	9	1	3	5
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## APOTHECARIES WEIGHT.

$\overline{3}$	$\overline{3}$	$\overline{9}$	gr.	$\overline{3}$	$\overline{3}$	$\overline{9}$	gr.	$\overline{16}$	$\overline{3}$	$\overline{3}$	$\overline{9}$	$\overline{16}$	$\overline{3}$	$\overline{3}$	$\overline{9}$
( <sup>1</sup> )27	1	-	1	( <sup>2</sup> )3	1	2	4	( <sup>3</sup> )5	2	1	-	( <sup>4</sup> )9	7	2	1
15	2	-	7	1	-	-	7	2	5	2	1	6	7	3	1
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## CLOTH MEASURE.

FE.	qrs.	n.	yds.	qrs.	n.	yds.	qrs.	n.	EE.	qrs.	n.
( <sup>1</sup> )35	2	2	( <sup>1</sup> )47	1	-	( <sup>3</sup> )71	1	2	( <sup>4</sup> )35	2	1
17	2	1	35	2	2	3	2	1	14	3	2
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## LONG MEASURE.

f.	in.	bar.	yds.	f.	in.	m.	fur.	p.	l.	m.	f.	p.
( <sup>1</sup> )25	1	-	( <sup>2</sup> )37	2	1	( <sup>3</sup> )52	1	27	( <sup>4</sup> )71	1	7	-
17	2	2	15	2	7	25	7	34	50	-	3	27
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## LAND MEASURE.

a.	r.	p.	a.	r.	p.	a.	r.	p.	a.	r.	p.
( <sup>1</sup> )75	1	27	( <sup>2</sup> )37	1	27	( <sup>3</sup> )25	-	1	( <sup>4</sup> )325	2	1
59	-	27	35	2	15	17	1	-	279	3	5
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## WINE MEASURE.

run.	gal.	qts.	tier.	gal.	qts.	hbds.	gal.	qts.	tun.	hhd.	gal.
( <sup>1</sup> )72	1	1	( <sup>2</sup> )27	27	1	( <sup>3</sup> )75	57	1	( <sup>4</sup> )79	2	14
35	1	2	19	35	2	57	59	1	35	3	27
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## ALE and BEER MEASURE.

AB.	fir.	gal.	BB.	fir.	gal.	hbds.	gal.	qts.	hhd.	gal.	qts.
( <sup>1</sup> )25	1	2	( <sup>2</sup> )37	2	1	( <sup>3</sup> )27	27	1	( <sup>4</sup> )709	2	2
21	1	5	25	1	7	12	50	2	157	2	2
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## DRY MEASURE.

qu.	bu.	p.	qu.	bu.	p.	ch.	bu.	p.	ch.	bu.	p.
( <sup>1</sup> )72	1	3	( <sup>2</sup> )65	2	1	( <sup>3</sup> )79	3	-	( <sup>4</sup> )35	3	3
35	2	3	57	2	3	54	7	1	23	5	1
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	<i>b.</i>	<i>m.</i>	<i>u.</i>		<i>d.</i>	<i>b.</i>	<i>m.</i>		<i>m.</i>	<i>u.</i>	<i>d.</i>		<i>m.</i>	<i>u.</i>	<i>d.</i>
(1)	75	1	27	(2)	72	1	51	(3)	35	2	1	(4)	65	2	1
	52	7	31		36	3	27		17	3	5		14	1	1
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## THE APPLICATION.

(1) A man born in the year 1723; what was his age in the year 1796? *Ans.* 73.

(2) What is the difference between the age of a man born in 1710, and another born in 1766? *Ans.* 56.

(3) A merchant had 5 debtors, A, B, C, D, and E; which together owed him 1156*l.*; B, C, D, and E, owed him 737*l.*—What was A's debt? *Ans.* £419.

(4) When an estate of 300*l.* *per annum* is reduced, on paying of taxes, to 12 score and 14*l.* 6*s.*—What is the tax? *Ans.* £45 : 14.

(5) What is the difference between 9154, and the amount of 754 added to 305? *Ans.* 8095.

(6) A horse in his furniture is worth 37*l.* 5*s.* out it 14 guineas—how much does the price of the furniture exceed that of the horse? *Ans.* £7 : 17*s.*

(7) A merchant, at his out-setting in trade, owed 750*l.* he had in cash, commodities, the stocks, and good debts, 12510*l.* 7*s.*; he cleared the first year by commerce, 452*l.* 3*s.* 6*d.*—what was the neat balance at the twelve months end? *Ans.* £12212 : 10 : 6.

(8) A gentleman dying left 45247*l.* between two daughters; the youngest was to have 15 thousand, 15 hundred, and twice 15*l.*, what was the eldest sister's fortune? *Ans.* £28717.

(9) A, B, C, and D, sent their money to the banker's, and drew upon him in this manner: Jan. 3. 1794, A sent in 152*l.* 12*s.*; B had 132*l.* 15*s.* 2*d.* good in the banker's hands, and on the 10th sent in 52*l.* 12*s.* 6*d.* more; C, after taking out 100*l.* found he had left in the banker's hands 173*l.* 8*s.* 4*d.* and on the sixth added 175*l.* to his stock. The day following, D made up his stock, 172*l.* 12*s.* 6*d.* and on the 10th drew for 121*l.* 6*s.* 2*d.* On the 12th, A drew for 119*l.* 12*s.* 3*d.* and sent in good bills to the amount of 171*l.* 11*s.* 5*d.* The same day B drew for 142*l.* 14*s.* 6*d.* as did C for 205*l.* 10*s.* On the 20th D sent in 128*l.* 12*s.* 4*d.* and the next day drew for 93*l.* 15*s.* 2*d.* On the 30th they drew 20 guineas each, and in the afternoon sent in

30 guineas each. I desire to know how their accounts stood separately with the banker?

*Ans.* A had left in the banker's hands £215 : 1 : 2.

B £53 : 3 : 2.—C £153 : 8 : 4—D £96 : 13 : 6d.

(10) A tradesman happening to fail in business, called all his creditors together, and found he owed to A 53*l.* 7*s.* 6*d.* to B 105*l.* 10*s.*; to C 34*l.* 5*s.* 2*d.*; to D 28*l.* 16*s.* 5*d.*; to E 14*l.* 15*s.* 8*d.*; to F 112*l.* 9*s.*; and to G 143*l.* 12*s.* 9*d.* His creditors found the value of his stock to be 212*l.* 6*s.*; and that he had owing him in good book debts 112*l.* 8*s.* 3*d.* besides 21*l.* 10*s.* 5*d.* money in hand. As his creditors took all his effects into their hands, I desire to know whether they were losers or gainers, and how much?

*The creditors lost* £146 : 11 : 10.

(11) My correspondent at Seville, in Spain, sends me the following account of money received at different sales for goods sent him by me, *viz.* bees-wax to the value of 37*l.* 15*s.* 4*d.*; stockings 37*l.* 6*s.* 7*d.*; tobacco 125*l.* 11*s.* 6*d.*; linen cloth 112*l.* 14*s.* 8*d.*; tin 115*l.* 10*s.* 5*d.* My correspondent at the same time informs me, that he has shipped, agreeable to my order, wines to the value of 250*l.* 15*s.*; fruit to the value of 51*l.* 12*s.* 6*d.*; figs 19*l.* 17*s.* 6*d.* oil 19*l.* 12*s.* 4*d.*; and Spanish wool to the value of 115*l.* 15*s.* 6*d.* I desire to know how the account stands between us, and who is the debtor? *Ans.* Due to my Spanish correspondent £28 : 14 : 4.

### MULTIPLICATION of several DENOMINATIONS.

**RULE.** Multiply the first denomination by the quantity given, dividing the product by as many of that as make one of the next, setting down the remainder, and add the quotient to the next superior, after it is multiplied.

If the given quantity is above 12, multiply by any two numbers, which multiplied together will make the same number; but if no two numbers multiplied together will make the exact number, then multiply the top line by as many as is wanting, adding it to the last product.

**PROOF** By Division.

£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.				
(1)	35	12	7 $\frac{1}{4}$	(2)	75	13	1 $\frac{1}{2}$	(3)	62	5	4 $\frac{1}{4}$	(4)	57	2	4 $\frac{3}{4}$
		2			3					4				5	
<hr/>												<hr/>			
71 : 5 : 2 $\frac{1}{2}$												<hr/>			
<hr/>												<hr/>			

lb. oz. dwt. gr. ton. cwt. qrs. lb. yds. qr. n. m. fur. p.  
 (5) 8 5 17 4 (6) 25 7 2 1 (7) 27 1 2 (8) 36 7 5  
                     7                                      8                                      2                                      5

a. r. p AB. fir. gal. BB. fir. gal. m. fur. p.  
 (9) 7 2 1 (10) 32 1 7 (11) 26 2 7 (12) 54 2 1  
                     9                                      7                                      3                                      5

(1) 18 ds. of cloth at 9s. 6d. (2) 26 lb. of tea, at £1 2 6  
 per yd. 9 per lb. 8  
 9 × 2 = 18      8 × 3 + 2 = 26  
                     4 5 6                                      9 - -  
                                 2    3  
                     8 11 -                                      27 - -  
   Top line × 2 = 2 5 -  
   29 5 -

(3) 21 ells of Holland, at 7s. 8½d. per ell.

Facit £8 : 1 : 10½.

(4) 34 firkins of butter, at 15s. 3½d. per firkin.

Facit £25 : 19 : 11.

(5) 75 lb. of nutmegs, at 7s. 2¾d. per lb.

Facit £27 : 2 : 2¼.

(6) 37 yards of tabby, at 9s. 7d. per yard.

Facit £17 : 14 : 7.

(7) 97 cwt. of cheese, at 1l. 5s. 3d. per cwt.

Facit £122 : 9 : 3.

(8) 43 dozen of candles, at 6s. 4d. per dozen.

Facit £13 : 12 : 4.

(9) 127 lb. of bohea, at 12s. 3d. per lb.

Facit £77 : 15 : 9.

(10) 135 gallons of rum, at 7s. 5d. per gallon.

Facit £50 : 11 : 3.

(11) 74 ells of diaper, at 1s. 4½d. per ell.

Facit £5 : 1 : 9.

(12) 6 dozen pair of gloves, at 1s. 10d. per pair.

Facit £6 : 12s.

When the given quantity consists of  $\frac{1}{2}$ ,  $\frac{1}{4}$ , divide the price by  $\frac{1}{2}$ ,  $\frac{1}{4}$ , when  $\frac{3}{4}$  divide the price by  $\frac{1}{2}$ , and that quotient by  $\frac{1}{2}$ , which add to the product of the quantity given.



(<sup>13</sup>) 25½ ells of Holland, at 3s. 4½d. per ell.

$$\begin{array}{r}
 5 \\
 \hline
 5 \times 5 = 25 \\
 \hline
 16 : 10\frac{1}{2} \\
 \hline
 5 \\
 \hline
 4 : 4 : 4\frac{1}{2} = 25 \\
 - : 1 : 8\frac{1}{4} = \frac{1}{2} \\
 \hline
 4 : 6 : -\frac{3}{4} = 25\frac{1}{2}
 \end{array}$$

(<sup>14</sup>) 75½ ells of diaper, at 1s. 3d. per ell,

*Facit* £4 : 14 : 4½.

(<sup>15</sup>) 19½ ells of damask, at 4s. 3d. per ell,

*Facit* £4 : 2 : 10½.

(<sup>16</sup>) 35¼ ells of dowlas, at 1s. 4d. per ell,

*Facit* £2 : 7.

(<sup>17</sup>) 7¼ cwt. of Malaga raisins, at 1l. 1s. 6d. per cwt.

*Facit* £7 : 15 : 10½.

(<sup>18</sup>) 6½ barrels of herrings, at 3l. 15s. 7d. per barrel,

*Facit* £24 : 11 : 3½.

(<sup>19</sup>) 35½ cwt. of double-refined sugar, at 4l. 15s. 6d. per cwt.

*Facit* £169 : 10 : 3.

(<sup>20</sup>) 154½ cwt. of tobacco, at 4l. 17s. 10d. per cwt.

*Facit* £755 : 15 : 3.

(<sup>21</sup>) 117¼ gallons of arrac, at 12s. 6d. per gallon,

*Facit* £73 : 5 : 7½.

(<sup>22</sup>) 85¾ cwt. of cheese, at 1l. 7s. 8d. per cwt.

*Facit* £118 : 12 : 5.

(<sup>23</sup>) 29¼ lb. of fine hyson tea, at 1l. 3s. 6d. per lb.

*Facit* £34 : 7 : 4½.

(<sup>24</sup>) 17¾ yds. of superfine scarlet drab, at 1l. 3s. per yard.

*Facit* £20 : 8 : 3.

(<sup>25</sup>) 37½ yards of rich brocaded silk, at 12s. 4d. per yard.

*Facit* £23 : 2 : 6.

(<sup>26</sup>) 56¾ cwt. of sugar, at 2l. 18s. 7d. per cwt.

*Facit* £166 : 4 : 7¼.

(<sup>27</sup>) 96½ cwt. of currants, at 2l. 15s. 6d. per cwt.

*Facit* £277 : 15 : 9.

(<sup>28</sup>) 45¾ lb. of Balladine silk, at 18s. 6d. per lb.

*Facit* £42 : 6 : 4½.

(<sup>29</sup>) 87¾ bushels of wheat, at 4s. 3d. per bushel.

*Facit* £18 : 12 : 11¼.

(<sup>30</sup>) 120¾ cwt. of hops, at 4l. 7s. 6d. per cwt.

D

*Facit* £528 : 5 : 7½.

## The APPLICATION.

(<sup>1</sup>) What sum of money must be divided amongst 18 men, so that each may receive 14*l.* 16*s.* 8½*d.*? *Ans.* £258:0:9.

(<sup>2</sup>) A privateer of 250 men took a prize, which amounted to 125*l.* 15*s.* 6*d.* to each man—what was the value of the prize? *Ans.* £31443:15*s.*

(<sup>3</sup>) What is the difference between 6 dozen dozen, and half a dozen dozen—and what is their sum and product? *Ans. diff.* 792, *sum* 936, *product* 62208.

(<sup>4</sup>) What difference is there between twice eight and fifty, and twice fifty-eight—and what is their product? *Ans. diff.* 50; *product* 7656.

(<sup>5</sup>) There are two numbers, the greater of them is 37 times 45, and their difference 19 times 4—their sum and product are required? *Ans. sum* 3254; *prod.* 2645685.

(<sup>6</sup>) The sum of two numbers is 360, the least of them 144—what is their product, and the square of their difference? *Ans. product* 31104, *square of their difference* 5184.

(<sup>7</sup>) If an army consisting of 187 squadrons of horse, each 157 men, and 207 battalions, each 560 men—how many effective soldiers, supposing that in 7 hospitals there are 473 sick? *Ans.* 144806.

(<sup>8</sup>) What sum did that gentleman receive in dowry with his wife, whose fortune was her wedding-suit: her petticoat having two rows of furbelows, each furbelow 87 quills, and each quill 21 guineas? *Ans.* £3836:14*s.*

(<sup>9</sup>) A merchant had 19118*l.* to begin trade with: for 5 years together he cleared 1086*l.* a-year; the next 4 years he made good 2715*l.* 10*s.* 6*d.* a-year; but the last 3 years he was in trade, had the misfortune to lose one year with another, 475*l.* 4*s.* 6*d.* a-year—what was his real fortune at 12 years end? *Ans.* £33984:8:6.

(<sup>10</sup>) In some parts of the kingdom they weigh their coals by a machine, in the nature of a steelyard, waggon and all. Three of these draughts together amount to 137 cwt. 2 qrs. 10lb. and the tare or weight of the waggon 13 cwt. 1 qr.—how many coals had the customer in twelve such draughts? *Ans.* 391 cwt. 1 qr. 12 lb.

(<sup>11</sup>) A certain gentleman lays up every year 294*l.* 12*s.* 6*d.* and spends daily 1*l.* 12*s.* 6*d.*—I desire to know what is his annual income? *Ans.* £887:15*s.*

(<sup>12</sup>) A tradesman gave to his daughter as a marriage-portion a scrutoire, in which were twelve drawers, in each drawer were six divisions, and in each division there were 50*l.* four crown pieces, and eight half-crown pieces—how much had she to her fortune? *Ans.* £3744.

(<sup>13</sup>) Admitting that I pay eight guineas and half a crown for a quarter's rent, and am allowed quarterly 15*s.* for trifling repairs, what does my apartment cost me annually, and how much in seven years?

*Ans.* In one year £31 : 2*s.* In seven £217 : 14*s.*

(<sup>14</sup>) A robbery being committed on the highway, an assessment was made on a neighbouring hundred for the sum of 386*l.* 15*s.* 6*d.* of which four parishes paid each 37*l.* 14*s.* 2*d.* four hamlets 31*l.* 4*s.* 2*d.* each, and the four townships 18*l.* 12*s.* 6*d.* each—how much was the deficiency?

*Ans.* £36 : 12 : 2.

(<sup>15</sup>) A gentleman at his decease left his widow 4560*l.*; to a public charity he bequeathed 572*l.* 10*s.*; to each of his four nephews 750*l.* 10*s.*; to each of his four nieces 375*l.* 12*s.* 6*d.*; to 30 poor housekeepers ten guineas each, and 150 guineas to his executor—what sum must he have been possessed of at the time of his death to answer all these legacies?

*Ans.* £10109 : 10*s.*

(<sup>16</sup>) Admit 20 to be the remainder of a division sum, 423 the quotient, the divisor the sum of both, and 19 more, what was the number of the dividend? *Ans.* 195446.

### DIVISION of several DENOMINATIONS.

**RULE.** Divide the first denomination on the left hand, and, if any remains multiply them by as many of the next less as make one of that, which add to the next, and divide as before. **PROOF,** by Multiplication.

£. s. d.      £. s. d.      £. s. d.      £. s. d.  
(<sup>1</sup>) 2) 25 : 2 : 4    (<sup>2</sup>) 3) 37 : 7 : 7    (<sup>3</sup>) 4) 57 : 5 : 7    (<sup>4</sup>) 5) 52 : 7 : 0

12 : 11 : 2

lb. oz. dwt. gr.      lb. oz. dr.      t. cwt. qr. lb.  
(<sup>5</sup>) 6) 75 : 3 : 7 : 5    (<sup>6</sup>) 7) 35 : 14 : 13    (<sup>7</sup>) 8) 5 : 10 : 1 : 13  
yds. qrs. n.      m. f. p.      yds. ft. in.

(<sup>8</sup>) 9) 35 : 1 : 3    (<sup>9</sup>) 10) 76 : 3 : 27    (<sup>10</sup>) 11) 75 : 2 : 9  
a. b. fir. gal.      b. b. fir. gal.      ch. bu. pk.

(<sup>11</sup>) 12) 35 : 2 : 5    (<sup>12</sup>) 13) 55 : 3 : 7    (<sup>13</sup>) 14) 357 : 2 : 1



## The APPLICATION.

(<sup>1</sup>) If a man spends 257*l.* 2*s.* 5*d.* in 12 months time; what is that *per* month? *Ans.* £21: 8: 6 $\frac{1}{4}$ .

(<sup>2</sup>) The clothing of 35 charity boys came to 57*l.* 3*s.* 7*d.*—what is the expence of each? *Ans.* £1: 12: 8.

(<sup>3</sup>) If I give 37*l.* 6*s.* 4 $\frac{3}{4}$ *d.* for 9 pieces of cloth—what did I give *per* piece? *Ans.* £4: 2: 11.

(<sup>4</sup>) If 20 cwt. of tobacco came to 27*l.* 5*s.* 4 $\frac{1}{2}$ *d.*—at what rate is that *per* cwt.? *Ans.* £1: 7: 3.

(<sup>5</sup>) What is the value of one hoghead of beer, when 120 are sold for 154*l.* 7*s.* 10*d.* *Ans.* £1: 5: 9 $\frac{3}{4}$ .

(<sup>6</sup>) Bought 72 yards of cloth for 85*l.* 6*s.*—I desire to know at what rate *per* yard? *Ans.* £1: 3: 8 $\frac{1}{4}$ .

(<sup>7</sup>) Gave 275*l.* 3*s.* 4*d.* for 36 bales of cloth—what is that for 2 bales? *Ans.* £15: 5: 8 $\frac{3}{4}$ .

(<sup>8</sup>) A prize of 7257*l.* 3*s.* 6*d.* is to be equally divided among 500 sailors—what is each man's share? *Ans.* £14: 10: 3 $\frac{1}{4}$ .

(<sup>9</sup>) There are 2545 bullocks to be divided among 509 men—I desire to know how many each man had, and the value of each man's share, supposing every bullock worth 9*l.* 14*s.* 6*d.*

*Ans.* 5 bullocks each man; £48: 12: 6, each share.

(<sup>10</sup>) A gentleman has a garden walled in, containing 9625 yards, the breadth was 35 yards—what was the length? *Ans.* 275.

(<sup>11</sup>) A club in London, consisting of 25 gentlemen, joined for a lottery ticket of 10*l.* value, which came up a prize of 4000*l.*—I desire to know what each man contributed, and what each man's share came to?

*Ans.* each man contributed 8*s.*; each share 160*l.*

(<sup>12</sup>) A trader cleared 1156*l.* equally in 17 years—how much did he lay by in a year? *Ans.* £68.

(<sup>13</sup>) Another cleared 2805*l.* in 7 $\frac{1}{2}$  years—what was his yearly increase of fortune? *Ans.* £374.

(<sup>14</sup>) What number added to the 43d part of 4429 will raise it to 240? *Ans.* 137.

(<sup>15</sup>) Divide 20*s.* between A, B, and C, in such sort that A may have 2*s.* less than B, and C, 2*s.* more than B.

*Ans.* A 4*s.* 8*d.*; B 6*s.* 8*d.*; C 8*s.* 8*d.*

(<sup>16</sup>) If



(16) If there are 1000 men to a regiment, and but 50 officers—how many private men are there to one officer?

*Ans.* 19.

(17) What number is that, which, multiplied by 7847, will make the product 3013248?

*Ans.* 384.

(18) The quotient is 1083, the divisor 28604—what was the dividend if the remainder came out 1788?

*Ans.* 30979920.

(19) An army, consisting of 20,000 men took and plundered a city of 12,000*l.*—what was each man's share, the whole being equally divided among them?

*Ans.* 12*s.*

(20) My purse and money, said Dick to Harry, are worth 12*s.* 8*d.* but the money is worth seven times the purse, what did the purse contain?

*Ans.* 11*s.* 1*d.*

(21) A merchant bought two lots of tobacco, which weighed 12 cwt. 3 qrs. 15*lb.* for 14*l.* 15*s.* 6*d.* The difference in point of weight was 1 cwt. 2 qrs. 13*lb.* and of price 7*l.* 15*s.*—I desire to know their respective weights and value?

*Ans.* Lesser weight 5 cwt. 2 qrs. 15*lb.* Price £3 : 10 : 3.

Greater weight 7 cwt. 1 qr. Price £11 : 5 : 3.

(22) The Spectator mentions a club of fat people, whose number was only 15, and yet weighed no less than 3 tons, what was the weight of each person?

*Ans.* 4 cwt.

(23) Five auditors in a public office receive 10*l.* a quarter, for which they attend seven times during that period; but if one or more of them be absent at any time, then the absent persons' shares are divided among those who attend. A and B never miss attendance on these occasions; but C and D are generally absent twice in a quarter, and E once. When the payment becomes due, I wish to know what each has to receive?

*Ans.* A £2 : 9 : 0½ ⅔; B £2 : 9 : 0½ ⅔; C £1 : 10*s.*;

D £1 : 10*s.*; E £2 : 1 : 10½ ⅓.

(24) Divide 1000 crowns in such a manner between A, B, and C, that A may receive 129 more than B, and B 178 less than C.

*Ans.* A 360, B 231, C 409.

(25) A young fellow owed his guardian 74*l.* 18*s.* 2*d.* on balance. He paid off 41*l.* 14*s.* 8*d.* and then declared that his sister owed the gentleman half as much again as himself. Being told of this circumstance, she pays off in part 13½

12*s.* 10*d.* and gives out that her uncle Joseph was not less

D 3

in

in arrears than her brother and she together. In consequence of this the uncle pays in 24*l.* 7*s.* 3*d.* and then the uncle's brother, who, by the bye, was not the uncle of those children, for 150*l.* undertakes to set them all clear, and has 35*l.* 15*s.* 5*d.* to spare, according to his account: I desire to know whether this be true or not?

(<sup>26</sup>) Three boys met a servant-maid carrying apples to the market. The first took half what she had, but returned to her ten: The second took one third, but returned two; and the third took away half those she had left, but returned her one. She had then twelve apples left—how many had she at first?

*Ans.* 40.

## BILLS of PARCELS.

### HOSIER'S.

(<sup>1</sup>) *Mr. John Thomas*

*Bought of Samuel Green, March 7, 1800.*

		<i>s.</i>	<i>d.</i>	
8 Pair of worsted stockings	at	4	6	per pair <i>£</i>
5 Pair of thread ditto	at	3	2	—
3 Pair of black silk ditto	at	14	0	—
6 Pair of milled hose	at	4	2	—
4 Pair of cotton	at	7	6	—
2 Yards of fine flannel	at	1	8	per yard.

*£*7:12:2

### MERCER'S.

(<sup>1</sup>) *Mr. Isaac Grant*

*Bought of John Sims, March 12, 1800.*

		<i>s.</i>	<i>d.</i>	
15 Yards of satin	at	9	6	per yard <i>£</i>
18 Yards of flowered silk	at	17	4	—
12 Yards of rich brocade	at	19	8	—
16 Yards of farset	at	3	2	—
13 Yards of Genoa velvet	at	27	6	—
23 Yards of lustring	at	6	3	—

*£*62:2:5

LINEN.

LINEN-DRAPER'S.

(3) *Mr. Simon Surety*

*Bought of Josiah Short, March 27, 1800.*

		s.	d.	
4 Yards of cambric	at 12	6	per yard	£
12 Yards of muslin	at 8	3	—	
15 Yards of printed linen	at 5	4	—	
2 Dozen of napkins	at 2	3	each.	
14 Ells of diaper	at 1	7	per ell	
35 Ells of dowlas	at 1	1½	—	

£17:4:6½

MILLINER'S.

(4) *Mrs. Bright*

*Bought of Lucy Brown, April 5, 1800.*

		s.	d.	
18 Yards of fine lace	at 12	3	per yard	£
5 Pair of fine kid gloves	at 2	3	per pair	
4 Dozen of Irish Lamb ditto	at 1	3	—	
12 Fans and French mounts	at 3	6	each.	
2 Fine laced tippets	at 63	0		
6 Sets of knots	at 2	6	per set	

£23:14:4

WOOLLEN-DRAPER'S.

(5) *Mr. Thomas Sage*

*Bought of Ellis Smith, April 7, 1800.*

		s.	d.	
17 Yards of fine serge	at 3	9	per yard	£
18 Yards of druggat	at 9	0	—	
15 Yards of superfine scarlet	at 22	0	—	
16 Yards of black cloth	at 18	0	—	
25 Yards of shalloon	at 1	9	—	
17 Yards of drab cloth	at 17	6	—	

£59:5:0

LEATHER.

## LEATHER-SELLER'S.

(6) *Mr. Giles Harris**Bought of Abel Smith, April 15, 1800.*

	s.	d.
27 Calf skins	at 3	9 per skin £
75 Sheep ditto	at 1	7 —
36 Coloured ditto	at 1	8 —
15 Buck ditto	at 11	6 —
17 Russia hides	at 10	7 each
120 Lamb skins	at 1	2½ per skin

£38:17:5

## GROCER'S.

(7) *Mr. Richard Groves**Bought of Francis Elliott, April 21, 1800.*

	s.	d.
25 lb of lump sugar	at 0	6½ per lb. £
2 Loaves of double-refined, weight 15lb.	at 0	11½ —
14 lb. of rice,	at 0	3 —
28 lb. of Malaga raisins	at 0	5 —
15 lb. of currants	at 0	5½ —
7 lb. of black pepper	at 1	10 —

£3:2:9½

## CHEESE-MONGER'S.

(8) *Mr. Charles Croft**Bought of Samuel Grant, April 23, 1800.*

	s.	d.
8 lb. of Cambridge butter	at 0	6 per lb £
17 lb. of new cheese	at 0	4 —
½ Firkin of butter, wt. 28lb.	at 0	5½ —
5 Cheshire cheeses, wt. 127 lb.	at 0	4 —
2 Warwickshire do. wt. 15lb.	at 0	3 —
22 lb. of cream cheese	at 0	6 —

£3:19:7

CORN.



## CORN-CHANDLER'S.

(9) *Mr. Abraham Doyley**Bought of Isaac Jones, April 29, 1800.*

	s.	d.	
Tares, 19 bushels	at	1 10	per bushel £
Peas, 18 bushels	at	3 9½	—
Beans, 12 bushels	at	4 8	—
Oats, 6 quarters	at	2 4	—
Malt, 7 quarters	at	25 0	per quarter
Hops, 15 lb.	at	1 5	per lb.

£23:7:4

## REDUCTION

IS the bringing or reducing numbers of one denomination into other numbers of another denomination, retaining the same value, and is performed by Multiplication and Division.

*First*, All great names are brought into small, by multiplying with so many of the less, as make one of the greater.

*Secondly*, All small names are brought into great, by dividing with so many of the less, as to make one of the greater.

## A TABLE of such COINS as are current in ENGLAND.

	£.	s.	d.
Guinea - - -	1	1	0
Half ditto - - -	0	10	6
Crown - - -	0	5	0
Half ditto - - -	0	2	6
Shilling - - -	0	0	12

☞ There are several pieces which speak their own value; such as six-pence, four-pence, three-pence, two-pence, penny, halfpenny, farthing.

## REDUCTION

REDUCTION *Descending.*(1) In 8*l.*—how many shillings and pence?

$$\begin{array}{r}
 20 \\
 \hline
 160 \text{ shillings.} \\
 12 \\
 \hline
 1920 \text{ pence.} \\
 \hline
 \hline
 \end{array}$$

(2) In 1*l.*—how many shillings, pence, and farthings?*Ans.* 24*s.*; 288*od.*; 11520 *far.*(3) How many shillings, pence, and farthings are there in 18*l.**Ans.* 360*s.*; 4320*od.*; 17280 *far.*(4) Reduce 7*l.* and a crown into shillings and pence.*Facit* 145*s.*; 1740*od.*

(5) How many farthings are there in 21 guineas?

*Ans.* 21168 *far.*(6) In 17*l.* 5*s.* 3½*d.*—how many farthings? *Ans.* 16573.(7) In 25*l.* 14*s.* 1*d.*—how many shillings and pence?*Ans.* 514*s.*; 6169*od.*

(8) In 15 crowns—how many shillings and pences?

*Ans.* 75*s.*; 150 *sixpences.*(9) How many crowns and shillings in 25*l.*?*Ans.* 100 crowns, 50*s.*

(10) In 57 half crowns—how many pence and farthings?

*Ans.* 1710*od.*; 6840 *farthings.*

(11) In 52 crowns, as many half-crowns, shillings, and pence—how many farthings?

*Ans.* 21424.(12) How many half-crowns, six-pences, and three-pences are there in 75*l.**Ans.* 600 half-crowns; 3000 *sixpences*; 6000 *threepences.*REDUCTION *Ascending.*

(13) In 1920 pence—how many shillings and pounds?

*Ans.* 160*s.*; 8*l.*

12) 1920

2| 160 (shillings.

8 pounds.

(14) In 11520 farthings, how many pence, shillings, and pounds? *Ans.* 288*od.*; 24*os.*; 12*l.*

(15) How many pence, shillings, and pounds, are there in 17280 farthings? *Ans.* 432*od.*; 360*s.*; 18*l.*

(16) Reduce 1740 pence into shillings and pounds.

*Facit* 145*s.*; £7:5*s.*

(17) How many guineas in 21168 farthings? *Ans.* 21*g.*

(18) In 16573 farthings—how many pounds?

*Ans.* £17:5:3 $\frac{1}{4}$

(19) In 6169 pence—how many shillings and pounds?

*Ans.* 514*s.*; £25:14:1.

(20) In 900 pence—how many shillings and crowns?

*Ans.* 75*s.*; 15 crowns.

(21) How many crowns and pounds in 500 shillings?

*Ans.* 100 crowns; 25*l.*

(22) In 6840 farthings—how many pence and half-crowns?

*Ans.* 1710*d.*; 57 half-crowns.

(23) In 21424 farthings—how many crowns, half-crowns, shillings, and pence, and of each an equal number?

*Ans.* 52.

(24) How many sixpences, half-crowns, and pounds, in 6000 three-pences?

*Ans.* 3000 sixpences; 600 half-crowns; 75*l.*

#### ASCENDING and DESCENDING.

(25) In 1560 pence—how many crowns and shillings?

*Ans.* 26 crowns; 130*s.*

6|0)156|0

26 cr.

5

130*s.*

(26) Reduce 130 shillings into crowns and pence?

*Facit* 26 crowns; 1560*d.*

(27) How many shillings, crowns, and pounds in 60 guineas?

*Ans.* 1260*s.*; 252 crowns; 63*l.*

(28) In 63*l.*—how many crowns, shillings, and guineas?

*Ans.* 252 crowns; 1260*s.*; 60 guineas.

(29) Reduce 76 moidores into shillings and pounds?

*Facit* 2052*s.*; £102:12*s.*

(30) Reduce 102*l.* 12*s.* into shillings and moidores?

*Facit* 2052*s.*; 76 moidores.

(<sup>31</sup>) How many shillings, half crowns, and crowns are there in 556*l*, and of each an equal number?

*Ans.* 1308 each, and 2*s*. over.

(<sup>32</sup>) In 1308 half crowns, as many crowns and shillings—how many pounds?

*Ans.* £555 : 18*s*.

(<sup>33</sup>) Seven men brought 35*l*. 10*s*. each into the mint, to be changed into guineas—how many must they have in all?

*Ans.* 103 guineas, 7*s*. over.

(<sup>34</sup>) If 103 guineas and 7 shillings are to be divided amongst 7 men—how many pounds sterling is that to each?

*Ans.* £15 : 10*s*.

(<sup>35</sup>) A certain person had 25 purses, and in each purse 12 guineas, a crown, and a moidore—how many pounds sterling had he in all?

*Ans.* £355.

(<sup>36</sup>) A gentleman in his will leaves 50*l*. to the poor, and ordered that  $\frac{1}{3}$  should be given to ancient men, each to have 5*s*.;  $\frac{1}{4}$  to poor women, each to have 2*s*. 6*d*.;  $\frac{1}{5}$  to poor boys, each to have 1*s*.;  $\frac{1}{6}$  to poor girls, each to have 9*d*.; and the remainder to the person that distributed it: I demand how many of each sort there were, and what the person that distributed the money had for his pains?

*Ans.* 66 men, 100 women, 200 boys, 222 girls, £2 : 13 : 6. to the person.

### TROY-WEIGHT.

(<sup>37</sup>) In 27 ounces of gold—how many grains?

*Ans.* 12960.

(<sup>38</sup>) In 12960 grains of gold—how many ounces?

*Ans.* 27.

(<sup>39</sup>) In 3 lb. 10 oz. 7 dwts. 5 gr.—how many grains?

*Ans.* 22253.

(<sup>40</sup>) In 8 ingots of silver, each weighing 7 lb. 4 oz. 17 dwts. 15 gr.—how many ounces, pennyweights, and grains?

*Ans.* 711 oz.; 14221 dwts.; 341304 grs.

(<sup>41</sup>) How many ingots of 7 lb. 4 oz. 17 dwt. 15 gr. each, are there in 341304 grains?

*Ans.* 8 ingots.

(<sup>42</sup>) Bought 7 ingots of silver, each containing 23 lb. 5 oz. 7 dwt.—how many grains?

*Ans.* 945336.

(<sup>43</sup>) A gentleman sent a tankard to his goldsmith that weighed 50 oz. 8 dwt. and ordered him to make it into spoons, each to weigh 2 oz. 16 dwt.—how many had he?

*Ans.* 18.

(<sup>44</sup>) A



(44) A gentleman delivered to a goldsmith 137 oz. 6 dwt. 9 gr. of silver, and ordered him to make it into tankards of 17 oz. 15 dwts. 6 gr. each; spoons of 21 oz. 11 dwts. 13 gr. *per dozen*; salts at 3 oz. 10 dwt. each; and forks at 21 oz. 11 dwt. 13 gr. *per dozen*; and for every tankard to have one salt, a dozen of spoons, and a dozen of forks. —What is the number of each he must have?

*Ans. two of each sort; 8 oz. 9 dwt. 17 gr. over.*

### AVOIRDUPOISE WEIGHT.

Note, *There are several sorts of silk which are weighed by a great pound of 24 oz. others by the common pound of 16 oz. therefore,*

To bring great pounds into common, multiply by 3, and divide by 2, or add one half.

To bring small pounds into great, multiply by 2, and divide by 3, or subtract one third.

*Things bought and sold by the tale.*

<i>Dozen.</i>		<i>Paper and Parchment.</i>	
12 Pieces or things make 1 doz.		24 Sheets make 1 quire.	
12 Dozen — 1 gros.		20 Quires — 1 ream.	
12 Gros, or 144 doz. }	1 great	2 Reams — 1 bund.	
	gros.	1 Doz. of par. 12 skins.	
		12 Skins — 1 roll.	

(45) In 14769 ounces—how many cwt?

*Ans. 8 cwt. 27 lb. 1 oz.*

(46) Reduce 8 cwt. 27 lb. 1 oz. into quarters, pounds, and ounces.

*Ans. 32 qrs. 923 lb. 14769 oz.*

(47) Bought 32 bags of hops, each 2 cwt. 1 qr. 14 lb. and another of 150 lb.—how many cwt. in the whole?

*Ans. 77 cwt. 1 qr. 10 lb.*

(48) In 34 tons, 17 cwt. 1 qr. 19 lb.—how many pounds?

*Ans. 78111.*

(49) In 350 great pounds—how many common? *Ans. 525.*

(50) In 27 cwt. of raisins—how many parcels of 18 lb each?

*Ans. 168.*

(51) In 9 cwt. 2 qrs. 14 lb. of indigo—how many pounds?

*Ans. 1078.*

(52) In 547 great pounds—how many common pounds?

*Ans. 820 lb. 8 oz.*

(<sup>53</sup>) Bought 27 bags of hops, each 2 cwt. 1 qr. 15 lb. and 1 bag of 137 lb. how many hundreds in the whole?

*Ans.* 65 cwt. 2 qrs. 10 lb.

(<sup>54</sup>) How many pounds in 27 hogheads of tobacco, each weighing neat  $8\frac{3}{4}$  cwt.

*Ans.* 26460.

(<sup>55</sup>) In 552 common pounds of silk—how many great pounds?

*Ans.* 368.

(<sup>56</sup>) How many parcels of sugar of 16 lb. 2 oz. are there in 16 cwt. 1 qr. 15 lb.

*Ans.* 113 par. 12 lb. 14 oz.

*The allowance usually made in this weight are TARE, TRET, and CLOFF.*

**TARE** is an allowance made to the buyer, for the weight of the box, barrel, bag, &c. which contains the goods bought, and is either at so much *per* box, bag, barrel, &c. At so much *per cent.* or—At so much in the gross weight.

**Tret** is an allowance of 4lb. in every 104 lb. for waste, dust, &c. made by the merchant to the buyer.

**Cloff** is the allowance of 2 lb. to the citizens of London, on every draught above 3 cwt. on some sort of goods.

**Gross weight** is the whole weight of any sort of goods, and that which contains it,

**Nettle** is when part of the allowance is deducted from the gross.

**Neat** is the pure weight, when all allowances are deducted.

**RULE 1.** When the tare is so much *per* bag, barrel, &c. multiply the number of bags, barrels, &c. by the tare, and subtract the product from the gross; the remainder is neat.

*Note, To reduce pounds into gallons, multiply by 2, divide by 15.*

(<sup>57</sup>) In 7 fraills of raisins, each weighing 5 cwt. 2 qrs. 5 lb. gross tare at 23 lb. *per* fraill—how much neat weight.

*Ans.* 37 cwt. 1 qr. 14 lb. or thus:

23	5 2 5	5 2 5
7	7	23
<hr/>	<hr/>	<hr/>
4(		
28)161(5—	38 3 7=gross.	5 1 10
140 1 1	1 1 21=tare.	7
<hr/>	<hr/>	<hr/>
21	37 1 14 neat.	37 1 14
<hr/>	<hr/>	<hr/>

(<sup>58</sup>) In 241 barrels of figs, each 3 qrs. 19 lb. gross; tare 10 lb. *per* barrel—how many pounds neat?

*Ans.* 22413.

(<sup>59</sup>) What

(<sup>59</sup>) What is the neat weight of 25 hogsheads of tobacco, weighing gross 163 cwt. 2 qrs. 15 lb. tare 100 lb. per hogshead? *Ans.* 141 cwt. 1 qr. 7 lb.

(<sup>60</sup>) In 16 bags of pepper, each 85 lb. 4 oz. gross, tare per bag 3 lb. 5 oz.—how many pounds neat? *Ans.* 1311.

RULE 2. When the tare is at so much in the whole gross weight, subtract the given tare from the gross, the remainder is neat.

(<sup>61</sup>) What is the neat weight of 5 hogsheads of tobacco, weighing gross 75 cwt. 1 qr. 14 lb.—tare in the whole 752 lb. *Ans.* 68 cwt. 2 qrs. 18 lb.

(<sup>62</sup>) In 75 barrels of figs, each 2 qrs. 27 lb. gross; tare in the whole 597 lb.—how much neat weight? *Ans.* 50 cwt. 1 qr.

RULE 3. When the tare is at so much per cwt. divide the gross weight by the aliquot parts of an cwt. which subtract from the gross, the remainder is neat.

*Note.* 7 lb. is  $\frac{1}{8}$ ; 8 lb. is  $\frac{1}{4}$ ; 14 lb. is  $\frac{1}{2}$ ; 16 lb. is  $\frac{1}{3}$ .

(<sup>63</sup>) What is the neat weight of 18 butts of currants, each 8 cwt. 2 qrs. 5 lb.; tare at 14 lb. per cwt.?

$$\begin{array}{r} 8 \quad 2 \quad 5 \\ 9 \times 2 = 18 \end{array}$$

$$\begin{array}{r} 76 \quad 3 \quad 17 \\ 2 \end{array}$$

$$14 = \frac{1}{8} \quad 153 \quad 3 \quad 6 \\ 19 \quad 0 \quad 25\frac{1}{4}$$

$$\begin{array}{r} 134 \quad 2 \quad 8\frac{3}{4} \end{array}$$

(<sup>64</sup>) In 25 barrels of figs, each 2 cwt. 1 qr. gross; tare per cent. 16 lb.—how much neat weight? *Ans.* 48 cwt. 24 lb.

(<sup>65</sup>) What is the neat weight of 9 hogsheads of nutmegs, each weighing gross 8 cwt. 3 qrs. 14 lb.; tare 16 lb. per cent.? *Ans.* 68 cwt. 1 qr. 24 lb.

(<sup>66</sup>) What is the neat weight of 12 casks of argol, gross 84 cwt. 2 qrs. 14 lb.; tare per cent. 14 lb.?

*Ans.* 74 cwt. 5  $\frac{1}{4}$  lb.

RULE 4. When tret is allowed with tare, divide the pounds futtle by 26, the quotient is the tret, which subtract from the futtle the remainder is neat.

(67) In one butt of currants, weighing 12 cwt. 2 qrs. 24 lb. gross; tare 14 lb. *per cent.* tret 4 lb. *per* 104 lb.—how many pounds neat?

12 2 24

4

50

28

14 =  $\frac{1}{8}$ ) 1424 gross.

178 tare.

26) 1246 futtle.

47 tret.

1199 neat.

(68) In 7 cwt. 3 qrs. 27 lb. gross; tare 36 lb. tret 4 lb. *per* 104 lb.—how many pounds neat? *Ans.* 826 lb.

(69) In 152 cwt. 1 qr. 3 lb. gross; tare 10 lb. *per cent.* tret 4 lb. *per* 104 lb.—how much neat weight? *Ans.* 133 cwt. 1 qr. 12 lb.

(70) In 15 chests of sugar, weighing 117 cwt. 21 lb. gross; tare 173 lb. tret 4 lb. *per* 104 lb.—how many cwt. neat? *Ans.* 111 cwt. 22 lb.

RULE 5. When cloff is allowed, multiply the cwt. futtle by 2, divide the product by 3; the quotient will be the pounds cloff, which subtract from the futtle, the remainder will be neat.

(71) What is the neat weight of 3 hogheads of tobacco, weighing 15 cwt. 3 qrs. 20 lb. gross; tare 7 lb. *per cent.* tret 4 lb. *per* 104 lb. cloff 2 lb. for 3 cwt.? *Ans.* 14 cwt. 1 qr. 3 lb.

7 =  $\frac{1}{16}$ ) 15 3 20 gross.

3 27 $\frac{1}{2}$  tare.

$\frac{1}{32}$ ) 14 3 20 $\frac{1}{2}$  futtle.

2 8 tret.

14 1 12 $\frac{1}{2}$  futtle.

9 $\frac{1}{2}$  cloff.

14 1 3 neat.

(72) In



(71) In 7 hogshheads of tobacco, each weighing gross 5 cwt. 2 qrs. 7 lb.; tare 8 lb. *per cent.* tret 4 lb. *per* 104 lb. cloff 2 lb. *per* 3 cwt.—how much neat weight?

*Ans.* 34 cwt. 2 qrs. 8 lb.

## APOTHECARIES' WEIGHT.

(73) In 27 lb. 7  $\frac{3}{4}$ . 2  $\frac{3}{4}$ . 1  $\frac{1}{2}$ . 2 gr.—how many grains?

*Ans.* 159022.

(74) How many lb.  $\frac{3}{4}$ .  $\frac{3}{4}$ .  $\frac{1}{2}$ . gr. are there in 159022 grains.

*Ans.* 27 lb. 7  $\frac{3}{4}$ . 2  $\frac{3}{4}$ . 1  $\frac{1}{2}$ . 2 gr.

## CLOTH MEASURE.

(75) In 27 yards—how many nails? *Ans.* 432.

(76) In 75 English ells—how many yards?

*Ans.* 93 yards. 3 qrs.

(77) In 93  $\frac{3}{4}$  yards—how many English ells? *Ans.* 75.

(78) In 24 pieces, each containing 32 Flemish ells—how many ells English?

*Ans.* 460 ells, 4 qrs.

(79) In 17 pieces of cloth, each 27 Flemish ells—how many yards?

*Ans.* 344 yds. 1 qr.

(80) Bought 27 pieces of English stuffs, each 27 ells—how many yards?

*Ans.* 911 yds. 1 qr.

(81) In 911  $\frac{1}{4}$  yards—how many English ells? *Ans.* 729.

(82) In 12 bales of cloth, each 25 pieces, each 15 English ells—how many yards?

*Ans.* 5625.

## LONG MEASURE.

(83) In 57 miles—how many furlongs and poles?

*Ans.* 456 furlongs, 18240 poles.

(84) In 7 miles—how many feet, inches, and barleycorns?

*Ans.* 36960 feet, 443520 inches, 1330560 barleycorns.

(85) In 18240 poles—how many furlongs and miles?

*Ans.* 456 furlongs, 57 miles.

(86) In 72 leagues—how many yards? *Ans.* 380160.

(87) In 380160 yards—how many miles and leagues?

*Ans.* 216 miles, 72 leagues.

(88) If from London to York be accounted 50 leagues, I demand how many miles, yards, feet, inches, and barleycorns?

*Ans.* 150 miles, 264000 yards, 792000 feet, 9504000 inches, 28512000 barleycorns.

## Reduction.

(92) How many barleycorns will reach round the world which is 360 degrees, each degree 69 miles and a half.

*Ans.* 4755801600 barleycorns.

## LAND MEASURE.

(93) 27 acres—how many roods and perches?

*Ans.* 108 roods, 4320 perches.

(94) In 4320 perches—how many acres? *Ans.* 27.

(95) A person having a piece of ground, containing 37 acres, 1 pole, has a mind to dispose of 15 acres to A; I desire to know how many perches he will have left? *Ans.* 3521.

(96) There are 4 fields to be divided into shares of 75 perches each; the first field containing 5 acres; the second 4 acres 2 poles; the third 7 acres 3 roods; and the fourth 2 acres 1 rood—I desire to know how many shares are contained therein?

*Ans.* 40 shares, 42 perches.

## WINE MEASURE.

(97) Bought 5 tuns of Port wine—how many gallons and pints? *Ans.* 1260 gallons; 10080 pints.

(98) In 10080 pints—how many tuns? *Ans.* 5.

(99) In 5896 gallons of Canary—how many pipes and hogsheads, and of each a like number?

*Ans.* 31 of each, 37 gallons over.

(100) A gentleman ordered his butler to bottle off  $\frac{2}{3}$  of a pipe of French wine into quarts, and the rest into pints—I desire to know how many dozen of each he had?

*Ans.* 28 dozen of each.

## ALE AND BEER MEASURE.

(101) In 46 barrels of beer—how many pints? *Ans.* 13248.

(102) In 10 barrels of ale—how many gallons and quarts?

*Ans.* 320 gals. 1280 qts.

(103) In 72 hogsheads of beer—how many barrels?

*Ans.* 108 barrels.

(104) In 108 barrels of beer—how many hogsheads?

*Ans.* 72.

## DRY MEASURE.

(105) In 120 quarters of wheat—how many bushels, pecks, gallons, and quarts?

*Ans.* 960 bushels, 3840 pecks, 7680 gallons, 30720 qts.

(106) In

(<sup>103</sup>) In 30720 quarts of corn—how many quarters?

*Ans.* 120.

(<sup>104</sup>) In 20 chaldron of coals—how many pecks?

*Ans.* 2880.

(<sup>105</sup>) In 273 lafts of corn—how many pecks? *Ans.* 87360.

TIME.

(<sup>106</sup>) In 70215 hours how many weeks?

*Ans.* 428 weeks, 4 days, 15 hours.

(<sup>107</sup>) How many day is it since the birth of our Saviour to Christmas 1794?

*Ans.* 655258½.

(<sup>108</sup>) Stow writes London was built 1108 years before our Saviour's birth—how many hours is it since to Christmas 1794?

*Ans.* 25438932 hours.

(<sup>109</sup>) From November 17, 1738, to Sept. 12, 1739, how many days?

*Ans.* 299 days.

(<sup>110</sup>) From July 18, 1723, to December 27, in the same year—how many days?

*Ans.* 162 days.

(<sup>111</sup>) From July 18, 1723, to April 18, 1750—how many years and days?

*Ans.* 26 years, 9 months, 3 weeks, 1 day, 6 hours; 9770¾ days, reckoning 365 days, 6 hours, to a year.

### THE SINGLE RULE OF THREE DIRECT

**TEACHETH,** by three numbers given to find out a fourth, in such proportion to the third, as the second is to the first.

**RULE.** First state the question, that is, place the numbers in such order, that the first and third be of one kind, and the second the same as the number required; then bring the first and third numbers into one name, and the second into the lowest term mentioned. Multiply the second and third numbers together, and divide the product by the first, the quotient will be the answer to the question, in the same denomination you left the second number in.

EXAMPLES.

(<sup>1</sup>) If 1 lb. of sugar cost 4½d.—what cost 54 lb.?

$$1 : 4\frac{1}{2} :: 54$$

$$\begin{array}{r} 4 \\ \hline 18 \end{array} \quad \begin{array}{r} 54 \\ 18 \\ \hline 4)972 \end{array}$$

*Ans.* £ 1 : 0 : 3.

$$12)243$$

20s. 3d.

56 *Single Rule of Three Direct.*

- (2) If a gallon of ale cost 3*d*.—what is that *per* barrel?  
*Ans.* 8*s*.
- (3) If a pair of shoes cost 4*s*. 6*d*.—what will 12 dozen come to?  
*Ans.* £32 : 8*s*.
- (4) If 12 dozen pair of stockings, cost 32*l*. 8*s*.—what is that *per* pair?  
*Ans.* 4*s*. 6*d*.
- (5) If 1 yard of cloth cost 15*s*. 6*d*.—what will 32 yards cost at the same rate?  
*Ans.* £24 : 16*s*
- (6) If 32 yards of cloth cost 24*l*. 16*s*.—what is the value of 1 yard?  
*Ans.* 15*s*. 6*d*.
- (7) If 1*lb*. of sugar cost 10½*d*.—what is the worth of 1 cwt.?  
*Ans.* £4 : 18*s*.
- (8) If I gave 4*l*. 18*s*. for a cwt. of sugar—at what rate did I buy it at *per* *lb*.?  
*Ans.* 10½*d*.
- (9) If I buy 20 pieces of cloth, each 20 ells, for 12*s*. 6*d*. *per* ell—what is the value of the whole?  
*Ans.* £250.
- (10) Bought 20 pieces of Holland, each 20 ells, for 250*l*.—what is that *per* ell?  
*Ans.* 12*s*. 6*d*.
- (11) What will 25 cwt. 3 qrs. 14 *lb*. of tobacco come to at 15½*d*. *per* *lb*.  
*Ans.* £187 : 3 : 3.
- (12) I gave 187*l*. 3*s*. 3*d*. for 25 cwt. 3 qrs. 14 *lb*. of tobacco—what rate did I buy it at *per* *lb*.?  
*Ans.* 1*s*. 3½*d*.
- (13) Bought 27¼ yards of muslin at 6*s*. 9½*d*. *per* yard—what does it amount to?  
*Ans.* £9 : 5 : 0¾ 2 rem.
- (14) Bought 17 cwt. 1 qr. 14 *lb*. of iron, at 3¼*d*. *per* *lb*.—what does it come to?  
*Ans.* £26 : 7 : 0½.
- (15) If coffee is sold for 5½*d*. *per* ounce—what must be given for 2 cwt.?  
*Ans.* £82 : 2 : 8.
- (16) How many yards of cloth may be bought for 21*l*. 11*s*. 1½*d*. when 3½ yards cost 2*l*. 14*s*. 3*d*.?  
*Ans.* 27 yds. 3 qrs. 1 nail, 84 rem.
- (17) If 3½ *lb*. of Cheshire cheese, cost 1*s*. 1*d*.—what cost 1 cwt.?  
*Ans.* £1 : 14 : 8.
- (18) If 1 cwt. of Cheshire cheese cost 1*l*. 14*s*. 8*d*.—what must I give for 3½ *lb*.?  
*Ans.* 1*s*. 1*d*.
- (19) Bought 1 cwt. 24 *lb*. 8 oz. of old lead, at 9*s*. *per* cwt.—what does it come to?  
*Ans.* 10*s*. 11½*d*. 896 rem.
- (20) If 1 cwt. 24 *lb*. 8 oz. of lead be worth 10*s*. 11½*d*. 896 rem.—what is that *per* cwt.?  
*Ans.* 9*s*.
- (21) If a gentleman's income is 500*l*. a-year, and he spends 19*s*. 4*d*. *per* day—how much does he lay by at the year's end?  
*Ans.* £147 : 3 : 4.
- (22) If



(<sup>22</sup>) If I buy 14 yards of cloth for 10 guineas—how many Flemish ells can I buy for 283*l.* 17*s.* 6*d.* at the same rate?  
*Ans.* 504 *Fl. ells* 2 *qrs.*

(<sup>23</sup>) If 283*l.* 17*s.* 6*d.* will buy 504 Flemish ells, 2 quarters—what quantity of yards can I have for 10*l.* 10*s.*?  
*Ans.* 14 *yds.*

(<sup>24</sup>) If 504 Flemish ells, 2 *qrs.* cost 283*l.* 17*s.* 6*d.*—at what rate must I give for 14 yards?  
*Ans.* *£* 10 : 10*s.*

(<sup>25</sup>) If I give 1*l.* 1*s.* 8*d.* for 3 *lb.* of coffee—what must be given for 29 *lb.* 4 *oz.*  
*Ans.* *£* 10 : 11 : 3

(<sup>26</sup>) Bought 29 *lb.* 4 *oz.* of coffee for 10 *lb.* 11*s.* 3*d.*—what is the value of 3 *lb.*?  
*Ans.* *£* 1 : 1 : 8

(<sup>27</sup>) If 1½ *oz.* of coffee cost 6½*d.*—what will 3½ *oz.* cost at the same rate?  
*Ans.* 1*s.* 1½*d.* 1 *rem.*

(<sup>28</sup>) If 1 English ell, 2 *qrs.* cost 4*s.* 7*d.*—what will 39½ yards cost at the same rate?  
*Ans.* *£* 5 : 3 : 5½ 5 *rem.*

(<sup>29</sup>) If one ounce of gold is worth 5*l.* 4*s.* 2*d.*—what is the worth of 1 grain?  
*Ans.* 2½*d.* 200 *rem.*

(<sup>30</sup>) If 14 yards of broad cloth cost 9*l.* 12*s.*—what is the purchase of 75 yards?  
*Ans.* *£* 51 : 8 : 6½ 6 *rem.*

(<sup>31</sup>) If 27 yards of Holland cost 5*l.* 12*s.* 6*d.*—how many ells English can I buy for 100*l.*?  
*Ans.* 384

(<sup>32</sup>) If 1 *cwt.* cost 12*l.* 12*s.* 6*d.*—what must I give for 14 *cwt.* 1 *qr.* 19 *lb.*?  
*Ans.* *£* 182 : 0 : 11½ 8 *rem.*

(<sup>33</sup>) Bought 7 yards of cloth for 17*s.* 8*d.*—what must be given for 5 pieces, each containing 27½ yards?  
*Ans.* *£* 17 : 7 : 0½ 1 *rem.*

(<sup>34</sup>) If 7 *oz.* 11 *dwt.* of gold be worth 35*l.*—what is the value of 14 *lb.* 9 *oz.* 12 *dwt.* 16 *gr.* at the same rate?  
*Ans.* *£* 823 : 9 : 3½ 552 *rem.*

(<sup>35</sup>) A draper bought 420 yards of broad cloth at the rate of 14*s.* 10¾*d.* *per* ell English—how much did he pay for the whole?  
*Ans.* *£* 250 : 5*s.*

(<sup>36</sup>) A gentleman bought a wedge of gold which weighed 14 *lb.* 3 *oz.* 8 *dwt.* for the sum of 514*l.* 4*s.*—at what rate did he pay for it *per* ounce?  
*Ans.* *£* 3

(<sup>37</sup>) A grocer bought 4 hogsheads of sugar, each weighing neat 6 *cwt.* 2 *qrs.* 14 *lb.* which cost him 2*l.* 8*s.* 6*d.* *per* *cwt.*—what is the value of the 4 hogsheads?  
*Ans.* *£* 64 : 5 : 3

(<sup>38</sup>) A draper bought 8 packs of cloth, each containing 4 parcels, each parcel 10 pieces, and each piece 26 yards, and gave after the rate of 4*l.* 16*s.* for 6 yards—I desire to know what the 8 packs stood him in?  
*Ans.* *£* 6656

(<sup>39</sup>) If 24 lb. of raisins cost 6*s.* 6*d.*—what will 18 fraills cost, each weighing neat 3 qrs. 18 lb. ? *Ans.* £24 : 17 : 3.

(<sup>40</sup>) If 1 ounce of silver be worth 5*s.*—what is the price of 14 ingots, each weighing 7 lb. 5 oz. 10 dwt. ? *Ans.* £313 : 5*s.*

(<sup>41</sup>) What is the price of a pack of wool weighing 2 cwt. 1 qr. 19 lb. at 8*s.* 6*d.* per stone ? *Ans.* £8 : 4 : 6½. 10 rem.

(<sup>42</sup>) Bought 59 cwt. 2 qrs. 24 lb. of tobacco, at 2*l.* 17*s.* 4*d.* per cwt.—what does it come to ? *Ans.* £171 : 3 : 7½. 80 rem.

(<sup>43</sup>) What is the half year's rent of 547 acres of land, at 15*s.* 6*d.* per acre per annum ? *Ans.* £211 : 19 : 3.

(<sup>44</sup>) Bought 171 tons of lead, at 14*l.* per ton, paid carriage, and other incident charges 4*l.* 10*s.*—I require the value of the lead, and what it stands me in per lb. ?

*Ans.* £2398 : 10*s.* ; value 1½*d.* per lb. ; 4320 rem.

(<sup>45</sup>) If a pair of stockings cost 10 groats—how many dozen may I buy for 43*l.* 5*s.* ? *Ans.* 21 doz. 7 pair.

(<sup>46</sup>) Bought 27 dozen 5 lb. of candles, after the rate of 1*s.* 5*d.* per 3 lb.—what did they cost me ?

*Ans.* £7 : 15 : 4½. 1 rem.

(<sup>47</sup>) If an ounce of fine gold is sold for 3*l.* 10*s.*—what come 7 ingots to, each weighing 3 lb. 7 oz. 14 dwt. 21 gr. at the same price ?

*Ans.* £1071 : 14 : 5½.

(<sup>48</sup>) If my horse stands me 9½*d.* per day keeping—what will be the charge of 11 horses for the year ?

*Ans.* £158 : 18 : 6½.

(<sup>49</sup>) A factor bought 86 pieces of stuff, which cost him 517*l.* 19*s.* 4*d.* at 4*s.* 10*d.* per yard—I demand how many yards there were, and how many ells English in a piece ?

*Ans.* 2143¾ yards, 14 rem.

and 19 ells, 4 quarters, 2 nails in a piece, 64 rem.

(<sup>50</sup>) A gentleman hath an annuity of 896*l.* 17*s.* per annum—I desire to know how much he may spend daily, that at the year's end he may lay up 200 guineas, and give to the poor quarterly 10 moidores ? *Ans.* £1 : 14 : 8. 44 rem.

### THE RULE OF THREE INVERSE.

**INVERSE PROPORTION** is, when more requires less, and less requires more. *More requires less*, is when the third term is greater than the first, and requires the fourth term to be less than the second. And *less requires more*, is when the

the third term is less than the first, and requires the fourth term is to be greater than the second.

RULE. Multiply the first and second terms together, and divide the product by the third; the quotient will bear such proportion to the second as the first does to the third.

EXAMPLES.

(1) If 8 men can do a piece of work 12 days—in how many days can 16 men perform the same? *Ans.* 6 days.

$$8 : 12 :: 16 : 6$$

8

—

$$16)96(6 \text{ days.}$$

96

==

(2) If 54 men can build a house in 90 days—how many men can do the same in 50 days? *Ans.*  $97\frac{1}{2}$  men.

(3) If when a peck of wheat is sold for 2s. the penny-loaf weighs 8 oz.—how much must it weigh when the peck is worth but 1s. 6d.? *Ans.* 10 oz.  $10\frac{2}{3}$  dr.

(4) How many pieces of money of 20s. value are equal to 240 pieces of 12s. each? *Ans.* 144.

(5) How many yards of three quarters wide are equal in measure to 30 yards of five quarters wide? *Ans.* 50.

(6) If I lend my friend 200l. for 12 months—how long ought he to lend 150l. to requite my kindness? *Ans.* 16 months.

(7) If for 24s. I have 1200 lb. carried 36 miles—how many pounds can I have carried 24 miles for the same money? *Ans.* 1800 lb.

(8) If 100 workmen finish a piece of work in 12 days—how many are sufficient to finish it in 3 days? *Ans.* 400.

(9) An army besieging a town, in which were 1000 soldiers, with provisions for three months—how many soldiers departed, when the provisions lasted them 6 months? *Ans.* 500.

(10) If 20l. worth of wine is sufficient to serve an ordinary of 100 men, when the tun is sold for 30l.—how many will 30l. worth suffice, when the tun is sold for but 24l.? *Ans.* 125 men.

(11) A courier makes a journey in 24 days, when the day is

is

is but 12 hours long—how many days will he be going the same journey, when the days are 16 hours long? *Ans.* 18 days.

(12) How much plush is sufficient for a cloak, which has in it 4 yards of 7 quarters wide of stuff for the lining, the plush being but 3 quarters wide? *Ans.*  $9\frac{1}{3}$  yards.

(13) If 14 pioneers make a trench in 18 days—how many days will 34 men take to do the same?

*Ans.* 7 days, 9 hours, 52 minutes, 32 rem.

(14) Borrowed of my friend 64*l.* for 8 months, and he hath occasion another time to borrow of me for 12 months—how much must I lend him to requite his former kindness to me?

*Ans.* £ 42 : 13 :  $\frac{1}{4}$ .

(15) A regiment of soldiers, consisting of 1000 men, are to have new coats, each coat to contain  $2\frac{1}{2}$  yards of cloth, 5 quarters wide, and to be lined with shalloon of 3 quarters wide—I demand how many yards of shalloon will line them.

*Ans.* 4166 yards, 2 quarters, 2 nails, 2 rem.

### THE DOUBLE RULE OF THREE

IS so called, because it is composed of 5 numbers given to find a sixth; which if the proportion is direct, must bear such proportion to the 4th and 5th, as the third bears to the 1st and 2d. But if Inverse, the 6th number must bear such proportion to the 4th and 5th, as the 1st bears to the 2d and 3d. The three first terms are a *supposition*; the two last a *demand*.

RULE-1. Let the principal cause of loss or gain, interest or decrease, action or passion, be put in the first place.

2. Let that which betokeneth time, distance of place, and the like, be in the second place, and the remaining one, in the third.

3. Place the other terms under their like, in the supposition.

4. If the blank falls under the third term, multiply the first and second terms for a divisor, and the other three for a dividend. But,

5. If the blank falls under the first or second term, multiply the 3d and 4th terms for a divisor, and the other three for the dividend, and the quotient will be the answer.

PROOF. By two Single Rules of Three.



# Double Rule of Three.

61

## EXAMPLES.

(1) If 14 horses eat 56 bushels of oats in 16 days—how many bushels will be sufficient for 20 horses in 24 days?

By two Single Rules.

$$\begin{array}{l} \text{hor. bu.} \quad \text{hor. bu.} \\ 1. \text{ As } 14 : 56 :: 20 : 80 \\ \quad \text{da. bu.} \quad \text{da. bu.} \end{array} \left\{ \begin{array}{l} \text{or in one stating worked thus:} \\ \text{hor. da. bu.} \\ 14 : 16 : 56 \\ 20 : 24 : - \end{array} \right. \frac{56 \times 20 \times 24}{14 \times 16} = 120.$$

2. As 16 : 80 :: 24 : 120

(2) If 8 men in 14 days can mow 112 acres of grass—how many men must there be to mow 2000 acres in 10 days?

$$\begin{array}{l} \text{ac. da.} \quad \text{ac. da.} \\ 1. \text{ As } 112 : 14 :: 2000 : 250 \\ \quad \text{da. m.} \quad \text{da. m.} \end{array} \left\{ \begin{array}{l} \text{m. da. ac.} \\ 8 : 14 : 112 \\ - : 10 : 2000 \end{array} \right. \frac{8 \times 14 \times 2000}{112 \times 10} = 200$$

(3) If 100*l.* in 12 months gain 6*l.* interest—how much will 75*l.* gain in 9 months?

Ans. £3 : 7 : 6.

(4) If a carrier receives 2*l.* 2*s.* for the carriage of 3 cwt. 150 miles—how much ought he to receive for the carriage of 7 cwt. 3 qrs. 14 lb. for 50 miles?

Ans. £1 : 16 : 9.

(5) If a regiment of soldiers, consisting of 136 men, consume 351 quarters of wheat in 108 days—how many quarters of wheat will 11232 soldiers consume in 56 days?

Ans. 15031. 854 rem.

(6) If 40 acres of grass be mowed by 8 men in 7 days—how many acres can be mowed by 24 men in 28 days?

Ans. 480.

(7) If 40*s.* will pay 8 men for 5 days work—how much will pay 32 men for 24 days work?

Ans. £38 : 8*s.*

(8) If 100*l.* in 12 months gain 6*l.* interest—what principal will gain 3*l.* 7*s.* 6*d.* in 9 months?

Ans. £75.

(9) If a regiment consisting of 939 soldiers, consume 351 quarters of wheat in 168 days—how many soldiers will consume 1404 quarters in 56 days?

Ans. 11268.

(10) If in a family consisting of 7 persons, there are drank out two kilderkins of beer in 12 days—how many kilderkins will there be drank out by another family of 14 persons in 8 days?

Ans. 2 kil. 12 gal.

(11) If the carriage of 60 cwt. 20 miles cost 14*l.* 10*s.*—what weight can I have carried 30 miles, for 5*l.* 8*s.* 9*d.* at the same rate of carriage?

Ans. 15 cwt.

(12) If 2 horses eat 8 bushels of oats in 16 days—how many horses will eat up 3000 quarters in 24 days?

Ans. 4000.

(13) If 100*l.* in 12 months gain 7*l.* interest—what is the interest of 57*l.* for 6 years?

Ans. £239 : 16 : 4<sup>3</sup>. 20 rem.

(14) If I pay 10s. for the carriage of 2 tons, 6 miles—  
what must I pay for the carriage of 12 tons, 17 cwt. for  
17 miles?

Ans. £9 : 2 : 0½.

## PRACTICE

IS so called, from the general use thereof by all persons concerned in trade and business.

All questions in this rule are performed by taking aliquot or even parts, by which means many tedious reductions are avoided: The table of which is as follows:

Of a Pound.			Of a Shilling.			Of a Ton.			Of an Hundred.		
s.	d.		d.			cwt.			qrs.	lb.	
10	0	is ½	6	is ⅓	⅓	10	is ⅓	⅓	2 or	56	is ⅓
6	8	— ⅓	4	— ⅓	⅓	5	— ⅓	⅓	1 or	28	— ⅓
5	0	— ⅓	3	— ⅓	⅓	4	— ⅓	⅓		14	— ⅓
4	0	— ⅓	2	— ⅓	⅓	2½	— ⅓	⅓	Of a Quarter.		
3	4	— ⅓	1½	— ⅓	⅓	2	— ⅓	⅓	14	lb	is ⅓
2	6	— ⅓	1	— ⅓	⅓				7	—	— ⅓
2	0	— ⅓							4	—	— ⅓
1	8	— ⅓							3½	—	— ⅓

RULE I. When the price is less than a penny, divide by the aliquot parts that are in a penny; then by 12 and 20, it will be the answer.

$$\begin{array}{r} (1) \frac{1}{4} \text{ is } \frac{1}{4} 5704 \text{ lb. at } \frac{1}{4} \\ 12 \overline{) 1426} \\ 2 \overline{) 0118} \text{ } 10 \\ \underline{\text{£ } 5 \quad 18 \quad 10} \end{array}$$

$$\begin{array}{r} (2) 7695 \text{ at } \frac{1}{2} \\ \text{facit } \text{£ } 16 \quad 0 \quad 7\frac{1}{2} \\ (3) 5740 \text{ at } \frac{1}{2} \\ \text{facit } \text{£ } 11 \quad 19 \quad 2 \end{array}$$

$$\begin{array}{r} (4) 6547 \text{ at } \frac{3}{4} \\ \text{facit } \text{£ } 20 \quad 9 \quad 2\frac{3}{4} \\ (5) 4573 \text{ at } \frac{1}{2} \\ \text{facit } \text{£ } 14 \quad 5 \quad 9\frac{1}{2} \end{array}$$

RULE II. When the price is less than a shilling, take the aliquot part or parts that are in a shilling, add them together, and divide by 20, as before.

$$\begin{array}{r} (1) 1 \text{ is } \frac{1}{2} 7547 \text{ at } 1 \text{ d.} \\ 2 \overline{) 0628} \text{ } 11 \\ \underline{\text{£ } 31 \quad 8 \quad 11} \end{array}$$

$$\begin{array}{r} (2) 54325 \text{ at } 1\frac{1}{2} \text{ d.} \\ \text{facit } \text{£ } 339 \quad 10 \quad 7\frac{1}{2} \end{array}$$

$$\begin{array}{r} (3) 3250 \text{ at } 2\frac{1}{2} \text{ d.} \\ \text{facit } \text{£ } 37 \quad 4 \quad 9\frac{1}{2} \end{array}$$

$$\begin{array}{r} (4) 6254 \text{ at } 1\frac{3}{4} \\ \text{facit } \text{£ } 45 \quad 12 \quad 0\frac{1}{2} \end{array}$$

$$\begin{array}{r} (5) 2715 \text{ at } 3 \text{ d.} \\ \text{facit } \text{£ } 33 \quad 18 \quad 9 \end{array}$$

$$\begin{array}{r} (6) 11 \text{ is } \frac{1}{2} 3751 \text{ at } 1\frac{1}{2} \text{ d.} \\ \frac{1}{4} \text{ is } \frac{1}{4} 312 \quad 7 \\ 78 \quad 1\frac{3}{4} \\ 2 \overline{) 0390} \text{ } 8\frac{1}{2} \\ \underline{\text{£ } 19 \quad 10 \quad 8\frac{1}{2}} \end{array}$$

$$\begin{array}{r} (7) 2351 \text{ at } 2 \text{ d.} \\ \text{facit } \text{£ } 19 \quad 11 \quad 10 \end{array}$$

$$\begin{array}{r} (8) 7062 \text{ at } 3\frac{1}{4} \text{ d.} \\ \text{facit } \text{£ } 95 \quad 12 \quad 7\frac{1}{2} \end{array}$$

$$\begin{array}{r} (9) 7210 \text{ at } 2\frac{1}{4} \text{ d.} \\ \text{facit } \text{£ } 67 \quad 11 \quad 10\frac{1}{2} \end{array}$$

$$\begin{array}{r} (10) 2147 \text{ at } 3 \text{ d.} \\ \text{facit } \text{£ } 31 \quad 6 \quad 2\frac{1}{2} \end{array}$$

$$\begin{array}{r} (11) 2710 \text{ at } 2\frac{1}{2} \text{ d.} \\ \text{facit } \text{£ } 28 \quad 4 \quad 7 \end{array}$$

$$\begin{array}{r} (12) 7000 \text{ at } 3\frac{3}{4} \text{ d.} \\ \text{facit } \text{£ } 109 \quad 7 \quad 6 \end{array}$$

( <sup>13</sup> ) 3257 at 4d. facit £54 5 8	( <sup>24</sup> ) 2708 at 6 $\frac{1}{4}$ d. facit £76 3 3	( <sup>35</sup> ) 7924 at 9 $\frac{1}{2}$ d. facit £313 13 2
( <sup>14</sup> ) 2056 at 4 $\frac{1}{2}$ d. facit £36 8 2	( <sup>25</sup> ) 3271 at 7d. facit £95 8 1	( <sup>36</sup> ) 2150 at 9 $\frac{1}{4}$ d. facit £87 6 10 $\frac{1}{2}$
( <sup>15</sup> ) 3752 at 4 $\frac{1}{2}$ d. facit £70 7 0	( <sup>26</sup> ) 3254 at 7 $\frac{1}{4}$ d. facit £98 5 11 $\frac{1}{2}$	( <sup>37</sup> ) 6325 at 10d. facit £263 10 10
( <sup>16</sup> ) 2107 at 4 $\frac{3}{4}$ d. facit £41 14 0	( <sup>27</sup> ) 2701 at 7 $\frac{1}{2}$ d. facit £84 8 1 $\frac{1}{2}$	( <sup>38</sup> ) 5724 at 10 $\frac{1}{4}$ d. facit £244 9 3
( <sup>17</sup> ) 3210 at 5d. facit £66 17 6	( <sup>28</sup> ) 3714 at 7 $\frac{3}{4}$ d. facit £119 18 7 $\frac{1}{2}$	( <sup>39</sup> ) 6327 at 10 $\frac{1}{4}$ d. facit £270 4 3 $\frac{3}{4}$
( <sup>18</sup> ) 2715 at 5 $\frac{1}{4}$ d. facit £59 7 9 $\frac{1}{4}$	( <sup>29</sup> ) 2710 at 8d. facit £90 6 8	( <sup>40</sup> ) 3254 at 10 $\frac{1}{2}$ d. facit £142 7 3
( <sup>19</sup> ) 3120 at 5 $\frac{1}{2}$ d. facit £71 10 0	( <sup>30</sup> ) 3514 at 8 $\frac{1}{4}$ d. facit £120 15 10 $\frac{1}{2}$	( <sup>41</sup> ) 7291 at 10 $\frac{3}{4}$ d. facit £326 11 6 $\frac{1}{4}$
( <sup>20</sup> ) 7521 at 5 $\frac{3}{4}$ d. facit £180 3 9 $\frac{3}{4}$	( <sup>31</sup> ) 2759 at 8 $\frac{1}{2}$ d. facit £97 14 3 $\frac{1}{2}$	( <sup>42</sup> ) 3256 at 11d. facit £149 4 8
( <sup>21</sup> ) 3271 at 6d. facit £81 15 6	( <sup>32</sup> ) 9872 at 8 $\frac{3}{4}$ d. facit £359 18 4	( <sup>43</sup> ) 7254 at 11 $\frac{1}{4}$ d. facit £340 0 7 $\frac{1}{2}$
( <sup>22</sup> ) 7914 at 6 $\frac{1}{4}$ d. facit £206 1 10 $\frac{1}{2}$	( <sup>33</sup> ) 5272 at 9d. facit £197 14 0	( <sup>44</sup> ) 3754 at 11 $\frac{1}{2}$ d. facit £179 17 7
( <sup>23</sup> ) 3250 at 6 $\frac{1}{2}$ d. facit £88 0 5	( <sup>34</sup> ) 6325 at 9 $\frac{3}{4}$ d. facit £243 15 6 $\frac{1}{4}$	( <sup>45</sup> ) 7972 at 11 $\frac{3}{4}$ d. facit £390 5 11

RULE III. When the price is more than one shilling, and less than two, take the part or parts, with so much of the given price as is more than a shilling, which add to the given quantity, and divide by 20, it will give the answer.

( <sup>1</sup> ) $\frac{1}{4} \frac{1}{8}$ 2106 at 12 $\frac{1}{4}$ d. 43 10 2 0 214 9 10 $\frac{1}{2}$ £107 9 10 $\frac{1}{2}$	( <sup>2</sup> ) $\frac{1}{12} \frac{1}{4}$ 3715 at 12 $\frac{1}{2}$ d. 154 9 $\frac{1}{2}$ 2 0 386 9 9 $\frac{1}{2}$ £193 9 9 $\frac{1}{2}$	( <sup>3</sup> ) 2712 at 12 $\frac{3}{4}$ d. facit £144 1 6
		( <sup>4</sup> ) 2107 at 1s. 1d. facit £114 2 7



(5) 3215 at 1s. $1\frac{1}{4}d.$ facit £177 9 $10\frac{3}{4}$	(20) 3725 at 1s. 5d. facit £263 17 1	(35) 1004 at 1s. $8\frac{3}{4}d.$ facit £86 16 1
(6) 2790 at 1s. $1\frac{1}{2}d.$ facit £156 18 9	(21) 7250 at 1s. $5\frac{1}{4}d.$ facit £521 1 $10\frac{1}{2}$	(36) 2104 at 1s. 9d. facit £184 2. 0
(7) 7904 at 1s. $1\frac{3}{4}d.$ facit £452 16 8	(22) 2597 at 1s. $5\frac{1}{2}d.$ facit £189 7 $3\frac{1}{2}$	(37) 2571 at 1s. $9\frac{1}{4}d.$ facit £227 12 $9\frac{3}{4}$
(8) 3750 at 1s. 2d. facit £218 15 0	(23) 7210 at 1s. $5\frac{3}{4}d.$ facit £533 4 $9\frac{1}{2}$	(38) 2104 at 1s. $9\frac{1}{2}d.$ facit £188 9 8
(9) 3291 at 1s. $2\frac{1}{4}d.$ facit £195 8 $0\frac{3}{4}$	(24) 7524 at 1s. 6d. facit £564 6 0	(39) 7506 at 1s. $9\frac{3}{4}d.$ facit £680 4 $7\frac{1}{2}$
(10) 9254 at 1s. $2\frac{1}{2}d.$ facit £559 1 11	(25) 7103 at 1s. $6\frac{1}{4}d.$ facit £540 2 $5\frac{3}{4}$	(40) 1071 at 1s. 10d. facit £98 3 6
(11) 7250 at 1s. $2\frac{3}{4}d.$ facit £445 11 $5\frac{1}{2}$	(26) 3254 at 1s. $6\frac{1}{2}d.$ facit £250 16 7	(41) 5200 at 1s. $10\frac{1}{4}d.$ facit £482 1 8
(12) 7591 at 1s. 3d. facit £474 8 9	(27) 7925 at 1s. $6\frac{3}{4}d.$ facit £619 2 $9\frac{3}{4}$	(42) 2117 at 1s. $10\frac{1}{2}d.$ facit £198 9 $4\frac{1}{2}$
(13) 6325 at 1s. $3\frac{1}{4}d.$ facit £401 18 $0\frac{1}{4}$	(28) 9271 at 1s. 7d. facit £723 19 1	(43) 1007 at 1s. $10\frac{3}{4}d.$ facit £95 9 $1\frac{1}{4}$
(14) 5271 at 1s. $3\frac{1}{2}d.$ facit £340 8 $4\frac{1}{2}$	(29) 7210 at 1s. $7\frac{1}{4}d.$ facit £578 6 $0\frac{1}{2}$	(44) 5000 at 1s. 11d. facit £479 3 4
(15) 3254 at 1s. $3\frac{3}{4}d.$ facit £213 10 $10\frac{1}{2}$	(30) 2310 at 1s. $7\frac{1}{2}d.$ facit £187 13 9	(45) 2105 at 1s. $11\frac{1}{4}d.$ facit £203 18 $5\frac{1}{4}$
(16) 2915 at 1s. 4d. facit £194 6 8	(31) 2504 at 1s. $7\frac{3}{4}d.$ facit £206 1 2	(46) 1006 at 1s. $11\frac{1}{2}d.$ facit £98 10 1
(17) 3270 at 1s. $4\frac{1}{4}d.$ facit £221 8 $1\frac{1}{2}$	(32) 1752 at 1s. 8d. facit £146 0 0	(47) 2707 at 1s. $11\frac{3}{4}d.$ facit £267 13 $7\frac{3}{4}$
(18) 7059 at 1s. $4\frac{1}{2}d.$ facit £485 6 $1\frac{1}{2}$	(33) 2905 at 1s. $8\frac{1}{4}d.$ facit £245 2 $2\frac{1}{4}$	(48) 5000 at 1s. $11\frac{1}{2}d.$ facit £489 11 8
(19) 2750 at 1s. $4\frac{3}{4}d.$ facit £191 18 $6\frac{1}{4}$	(34) 7104 at 1s. $8\frac{1}{2}d.$ facit £606 16 0	(49) 4000 at 1s. $11\frac{3}{4}d.$ facit £395 16 8



**RULE IV.** When the price consists of any even number of shillings under 20, multiply the given quantity by half the price, doubling the first figure of the product for shillings, and the rest of the product will be pounds.

( <sup>1</sup> ) 2750 at 2s. facit £275 0 0	( <sup>5</sup> ) 2102 at 10s. facit £1051 0 0	( <sup>9</sup> ) 1075 at 16s. facit £860 0 0
( <sup>2</sup> ) 3254 at 4s. facit £650 16 0	( <sup>6</sup> ) 2101 at 12s. facit £1260 12 0	( <sup>10</sup> ) 1621 at 18s. facit £1458 18 0
( <sup>3</sup> ) 2710 at 6s. facit £813 0 0	( <sup>7</sup> ) 5271 at 14s. facit £3689 14 0	When the price is 10s. take half of the quantity, and if any remains, it is 10s.
( <sup>4</sup> ) 1572 at 8s. facit £628 16 0	( <sup>8</sup> ) 3123 at 16s. facit £2498 8 0	

**RULE V.** When the price consists of odd shillings, multiply the given quantity by the price; and divide by 20; the product will be the answer.

( <sup>1</sup> ) 2703 at 1s. facit £135 3 0	( <sup>4</sup> ) 2715 at 7s. facit £950 5 0	( <sup>8</sup> ) 2150 at 15s. facit £1612 10 0
( <sup>2</sup> ) 3270 at 3s. 3 2 0(981 0 £490 10 0	( <sup>5</sup> ) 3214 at 9s. facit £1446 6 0	( <sup>9</sup> ) 3142 at 17s. facit £2670 14 0
( <sup>3</sup> ) 3271 at 5s. facit £817 15 0	( <sup>6</sup> ) 2710 at 11s. facit £1490 10 0	( <sup>10</sup> ) 2150 at 19s. facit £2042 10 0
	( <sup>7</sup> ) 3179 at 13s. facit £2066 7 0	( <sup>11</sup> ) 7157 at 19s. facit £6799 3 0

When the price is 5s. divide the quantity by 4, and if any remain it is 5s.

**RULE VI.** When the price is shillings and pence, and they the aliquot part of a pound, divide by the aliquot part and it will give the answer at once; but if they are not an aliquot part, then multiply the quantity by the shillings, and take parts of the rest, add them together and divide by 20.

s. d. 6 8	$\frac{1}{3}$	( <sup>1</sup> ) 2710 at 6s. 8d. facit £903 6 8	( <sup>9</sup> ) 2517 at 5s. 3d. facit £660 14 3
		( <sup>2</sup> ) 3150 at 3s. 4d. facit £525 0 0	( <sup>10</sup> ) 2547 at 7s. 3½d. facit £928 11 10½
		( <sup>3</sup> ) 2715 at 2s. 6d. facit £339 7 6	( <sup>11</sup> ) 3271 at 5s. 9½d. facit £947 4 6½
		( <sup>4</sup> ) 7150 at 1s. 8d. facit £595 16 8	( <sup>12</sup> ) 2103 at 15s. 4½d. facit £1616 13 7½
		( <sup>5</sup> ) 3215 at 1s. 4d. facit £214 6 8	( <sup>13</sup> ) 7152 at 17s. 6¾d. facit £6280 7s.
		( <sup>6</sup> ) 7211 at 1s. 3d. facit £450 13 9	( <sup>14</sup> ) 2510 at 14s. 7¼d. facit £1832 16 5½
2 $\frac{1}{6}$	$\frac{1}{6}$	( <sup>7</sup> ) 2710 at 3s. 2d. 3 8130 451 8 858   1 8 £429 1 8	( <sup>15</sup> ) 3715 at 9s. 4½d. facit £1741 8 1½
		( <sup>8</sup> ) 7514 at 4s. 7d. facit £1721 19 2	( <sup>16</sup> ) 2572 at 13s. 7½d. facit £1752 3 6
2   0	0		( <sup>17</sup> ) 7251 at 14s. 8¼d. facit £5324 19 0¾
			( <sup>18</sup> ) 3210 at 15s. 7¾d. facit £2511 3 1½
			( <sup>19</sup> ) 2710 at 19s. 2½d. facit £2602 14 7

RULE VII. 1st, When the price is pounds and shillings multiply the quantity by the pounds, and proceed with the shillings if they are even, as in the 4th rule; if odd, take the aliquot parts, add them together, the sum will be the answer.

2dly, When pounds, shillings, and pence, and the shillings and pence the aliquot parts of a pound, multiply the quantity by the pounds, and take parts for the rest.

3dly, When the price is pounds, shillings, pence, and farthings, and the shillings and pence not the aliquot parts of

of a pound, reduce the pounds and shillings, into shillings, multiply the quantity by the shillings, take parts for the rest, add them together and divide by 20.

When the given quantity is no more than three figures, proceed as in Compound Multiplication.\*

4s.	$\frac{1}{5}$	( <sup>1</sup> ) 7215 at £7 4 0 7 50505 1443 51948£
s. d.	$\frac{1}{8}$	( <sup>2</sup> ) 2104 at £5 3 0 5 10520 263 52 12 10835l. 12s.
6d.	$\frac{1}{8}$	( <sup>3</sup> ) 2107 at £2 8 0 facit £5056 16 ( <sup>4</sup> ) 7156 at £5 6 0 facit £37926 16
6d.	$\frac{1}{2}$	( <sup>5</sup> ) 2710 at £2 3 7 $\frac{1}{2}$ 43 116530 1355 338 9 11822 3 9 £5911 3 9
1 $\frac{1}{2}$ d.	$\frac{1}{4}$	( <sup>6</sup> ) 3125 at £1 17 0 facit £.5781 5s.

( <sup>7</sup> ) 2107 at £1 13 0 facit £3476 11s.
( <sup>8</sup> ) 3215 at £4 6 8 facit £13931 13 4
( <sup>9</sup> ) 2154 at £7 1 3 facit £15212 12 6
( <sup>10</sup> ) 2701 at £2 3 4 facit £5852 3 4
( <sup>11</sup> ) 2715 at £1 17 2 $\frac{1}{2}$ facit £5051 0 7 $\frac{1}{2}$
( <sup>12</sup> ) 2517 at £3 15 2 $\frac{1}{4}$ facit £9462 6 11 $\frac{1}{4}$
( <sup>13</sup> ) 210 at £1 18 6 $\frac{3}{4}$ facit £6189 5 7 $\frac{1}{2}$
( <sup>14</sup> ) 2157 at £2 7 4 $\frac{1}{2}$ facit £5109 7 10 $\frac{1}{2}$
( <sup>15</sup> ) 142 at £1 15 2 $\frac{3}{4}$ facit £250 2 6 $\frac{1}{2}$
( <sup>16</sup> ) 95 at £15 14 7 $\frac{1}{4}$ facit £1495 7 4 $\frac{3}{4}$
( <sup>17</sup> ) 37 at £1 17 5 $\frac{3}{4}$ facit £69 6 8 $\frac{3}{4}$
( <sup>18</sup> ) 2175 at £2 15 4 $\frac{1}{2}$ facit £6022 0 7 $\frac{1}{2}$
( <sup>19</sup> ) 2150 at £17 16 1 $\frac{1}{2}$ facit £38283 8 9

RULE VIII. When the price and quantity given are of several denominations, multiply the price by the integers, and take parts of the integers for the rest.

(<sup>1</sup>) At 3*l.* 17*s.* 6*d.* per cwt.—what is the value of 25 cwt. 2 qrs. 14 lb. of tobacco?

2	$\frac{1}{2}$	£3 : 17 : 6	5 × 5 = 25
		15	
		19 : 7 : 6	
		5	
lb.		96 : 17 : 6	
14	$\frac{1}{4}$	1 : 18 : 9	
		9 : 8 $\frac{1}{4}$	
		99 : 5 : 11 $\frac{1}{4}$	

(<sup>2</sup>) At 1*l.* 4*s.* 9*d.* per cwt.—what comes 17 cwt. 1 qr. 17 lb. of cheese to? *Ans.* £21 : 10 : 8  $\frac{1}{2}$

(<sup>3</sup>) Sold 85 cwt. 1 qr. 10 lb. of cheese, at 1*l.* 7*s.* 8*d.* per cwt.—what does it come to? *Ans.* £118 : 1 : 0  $\frac{1}{4}$

(<sup>4</sup>) Hops at 4*l.* 5*s.* 8*d.* per cwt.—what must be given for 72 cwt. 1 qr. 18 lb. *Ans.* £310 : 3 : 2

(<sup>5</sup>) At 1*l.* 1*s.* 4*d.* per cwt.—what is the value of 27 cwt. 2 qrs. 15 lb. of Malaga raisins? *Ans.* £29 : 9 : 6  $\frac{1}{2}$

(<sup>6</sup>) Bought 78 cwt. 3 qrs. 12 lb. of currants, at 2*l.* 17*s.* 9*d.* per cwt.—what did I give for the whole? *Ans.* £227 : 14*s.*

(<sup>7</sup>) Sold 56 cwt. 1 qr. 17 lb. of sugar, at 2*l.* 15*s.* 9*d.* the cwt.—what does it come to? *Ans.* £157 : 4 : 4  $\frac{1}{2}$

(<sup>8</sup>) Tobacco at 3*l.* 17*s.* 10*d.* the cwt.—what is the worth of 97 cwt. 15 lb? *Ans.* £378 : 0 : 3

(<sup>9</sup>) At 4*l.* 14*s.* 6*d.* the cwt.—what is the value of 37 cwt. 2 qrs. 13 lb. of double refined sugar? *Ans.* £177 : 14 : 8  $\frac{1}{2}$

(<sup>10</sup>) Bought sugar at 3*l.* 14*s.* 6*d.* the cwt.—what did I give for 15 cwt. 1 qr. 10 lb? *Ans.* £57 : 2 : 9

(<sup>11</sup>) At 4*l.* 15*s.* 4*d.* the cwt.—the value of 172 cwt. 3 qrs. 12 lb. of tobacco is required? *Ans.* £823 : 19 : 0  $\frac{1}{4}$

(<sup>12</sup>) Soap at 3*l.* 11*s.* 6*d.* the cwt.—what is the value of 53 cwt. 17 lb? *Ans.* £190 : 0 : 4

INTEREST,



## INTEREST.

INTEREST is either SIMPLE or COMPOUND.

## SIMPLE INTEREST

**I**S the PROFIT allowed in lending or forbearance of any sum of money for a determined space of time.

The PRINCIPAL is the money lent, for which interest is to be received.

The RATE PER CENT, is a certain sum agreed on between the borrower and the lender, to be paid for every 100*l.* for the principal 12 months.

The AMOUNT is the principal and interest added together.

INTEREST is also applied to Commission, Brokage, Purchasing of Stocks, and Insurance.

*To find the Interest of any Sum of Money for a Year.*

RULE. Multiply the principal by the rate *per cent.* that product, divided by 100, will give the interest required.

*For several Years.*

Multiply the interest of one year by the number of years given in the question, and the product will be the answer.

## EXAMPLES.

(1) What is the interest of 375*l.* for a year at 5 *per cent.* *per annum?*

$$\begin{array}{r} 5 \\ \hline 18|75 \\ 20 \\ \hline 15|00 \text{ Ans. } £18 : 15s. \end{array}$$

(2) What is the interest of 268*l.* for one year, at 4 *per cent.* *per annum?* *Ans. £10 : 14 : 4 $\frac{3}{4}$*

(3) What is the interest of 945*l.* 10*s.* for one year, at 4 *per cent.* *per annum?* *Ans. £37 : 16 : 4 $\frac{1}{2}$ .*

(4) What is the interest of 547*l.* 15*s.* at 3 *per cent.* *per annum* for three years? *Ans. £49 : 5 : 11 $\frac{1}{2}$ .*

(5) What

(<sup>5</sup>) What is the interest 254*l.* 17*s.* 6*d.* for five years, at 4 per cent. per annum? *Ans.* £50 : 19 : 6.

(<sup>6</sup>) What is the interest of 556*l.* 13*s.* 4*d.* at 5 per cent. per annum for 5 years? *Ans.* £139 : 3 : 4.

## COMMISSION

Is an allowance from merchants to their factors or correspondents, in the buying or selling of goods, and is generally at a certain rate *per cent.* according to the custom of the country where the factor resides.

**RULE.** Multiply the principal by the rate *per cent.* as before; and for  $\frac{1}{4}$ ,  $\frac{1}{2}$ , or  $\frac{3}{4}$ , take the part or parts from the principal, which added to the product, and divided by 100, will give the answer.

(<sup>7</sup>) What is the commission of 287*l.* 10*s.* at  $3\frac{1}{2}$  per cent.?

$$\frac{1}{2} \frac{1}{2}, 287 : 10$$

3

$$862 : 10 = 3$$

$$143 : 15 = \frac{1}{2}$$

$$10 | 06 : 5 = 3\frac{1}{2}$$

20

$$1 | 25$$

12

$$3 | 00 \text{ } \textit{Ans.} \text{ } £10 : 1 : 3.$$

(<sup>8</sup>) What must I allow my correspondent for disbursing on my account 529*l.* 18*s.* 5*d.* at  $2\frac{1}{2}$  per cent.? *Ans.* £11 : 18 :  $5\frac{1}{2}$ .

(<sup>9</sup>) My correspondent writes me word, that he has bought goods to the amount of 754*l.* 16*s.* on my account—what does his commission come to at  $2\frac{1}{2}$  per cent.?

$$\textit{Ans.} \text{ } £18 : 17 : 4\frac{1}{2}.$$

(<sup>10</sup>) If I allow my factor  $3\frac{3}{4}$  per cent. for commission—what may he demand on the laying out 876*l.* 5*s.* 10*d.*?

$$\textit{Ans.} \text{ } £32 : 17 : 2\frac{1}{2}.$$

## PURCHASING OF STOCKS.

**RULE.** Multiply the sum to be purchased by the excess above 100; divide the product by 100; the produce of which added to the given sum, is the purchase required.

If:

If under *par* (that is under 100) multiply by the rate *per cent.* that product, divided by 100, gives the purchase thereof.

(<sup>11</sup>) What is the purchase of 575*l.* 10*s.* bank stock, at 131 $\frac{1}{2}$  *per cent.*

$$6 \times 5 + 1 = 31$$

$$575 : 10$$

$$6$$

$$3453$$

$$5$$

$$17265 : 0 : 0 = 30$$

$$\frac{1}{2} \frac{1}{2} \quad 575 : 10 : 0 = 1$$

$$\frac{1}{4} \frac{1}{4} \quad 287 : 15 : 0 = \frac{1}{2}$$

$$143 : 17 : 6 = \frac{1}{4}$$

$$182 | 72 : 2 : 6 = 31 \frac{1}{4}$$

$$20$$

$$14 | 42$$

$$12$$

$$5 | 10$$

$$575 : 10 : 0$$

$$182 : 14 : 5$$

$$\text{Ans. } \underline{\underline{\underline{\pounds 758 : 4 : 5}}}$$

(<sup>12</sup>) What is the purchase, of 254*l.* 17*s.* bank annuities, at 97 $\frac{1}{2}$  *per cent.*?

$$12 \times 8 + 1 = 97$$

$$254 : 17$$

$$12$$

$$3058 : 4$$

$$8$$

$$24465 : 12 : 0 = 96$$

$$\frac{1}{4} \frac{1}{4} \quad 254 : 17 : 0 = 1$$

$$63 : 14 : 3 = \frac{1}{4}$$

$$247 | 84 : 3 : 3 = 97 \frac{1}{2}$$

$$20$$

$$16 | 83$$

$$12$$

$$9 | 99$$

$$4$$

$$3 | 96$$

$$\text{Ans. } \underline{\underline{\underline{\pounds 247 : 16 : 9 \frac{1}{2}}}}$$

(<sup>13</sup>) At 110 $\frac{1}{4}$  *per cent.*—what is the purchase of 2054*l.* 16*s.* South Sea Stock? *Ans.*  $\pounds 2265 : 8 : 4$ .

(<sup>14</sup>) At 104 $\frac{3}{8}$  *per cent.* South Sea annuities—what is the purchase of 1797*l.* 14*s.*? *Ans.*  $\pounds 1876 : 6 : 11 \frac{3}{4} +$

(<sup>15</sup>) What is the purchase of 2750*l.* 17*s.* South Sea old annuities, at 102 $\frac{5}{8}$  *per cent.*? *Ans.*  $\pounds 2823 : 1 : 2 \frac{1}{4} +$

(<sup>16</sup>) At 96 $\frac{3}{4}$  *per cent.*—what is the purchase of 577*l.* 19*s.* bank annuities? *Ans.*  $\pounds 559 : 3 : 3 : \frac{3}{4} +$

(<sup>17</sup>) At 124 $\frac{5}{8}$  *per cent.*—what is the purchase of 758*l.* 17*s.* 10*d.* India Stock? *Ans.*  $\pounds 945 : 15 : 4 \frac{1}{2} +$

## BROKAGE

Is an allowance to brokers for helping merchants or factors to persons to buy or sell them goods.

**RULE.** Divide the sum given by 100, and take parts from the quotient with the rate per cent.

(<sup>18</sup>) If I employ a broker to sell goods for me, to the value of 2575*l.* 17*s.* 6*d.*—what is the brokage at 4*s.* per cent.

$$\begin{array}{r} 2575 \ 17 \ 6 \\ 20 \end{array}$$

$$\begin{array}{r} 15 \ 17 \\ 12 \end{array}$$

$$\begin{array}{r} 2 \ 10 \end{array}$$

$$\begin{array}{r} 15 \ 17 \\ 12 \end{array}$$

$$\begin{array}{r} 2 \ 10 \end{array}$$

$$\begin{array}{r} 15 \ 17 \\ 12 \end{array}$$

$$\begin{array}{r} 2 \ 10 \end{array}$$

$$4s. \ \frac{1}{5} \ 25 \ 15 \ 2$$

$$Ans. \ \underline{\underline{5 \ 3 \ 0\frac{1}{4}}}$$

(<sup>19</sup>) What is the brokage of 796*l.* 14*s.* 7*d.* at 6*s.* per cent?

$$Ans. \ \underline{\underline{£2 : 17 : 9\frac{1}{4}}}$$

(<sup>20</sup>) When a broker sells goods to the amount of 7105*l.* 5*s.* 10*d.*—what may he demand for brokage, if he is allowed 5*s.* 6*d.* per cent.?

$$Ans. \ \underline{\underline{£19 : 10 : 9\frac{1}{4}}}$$

(<sup>21</sup>) If a broker is employed to buy a quantity of goods, to the value of 975*l.* 5*s.* 4*d.*—what is the brokage at 6*s.* 6*d.* per cent.?

$$Ans. \ \underline{\underline{£3 : 3 : 4\frac{1}{2}}}$$

When the time is  $\frac{1}{4}$ , or  $\frac{1}{2}$ , or  $\frac{3}{4}$  of a year, besides a number of years given.

**RULE.** Take parts of the interest for 1 year, which add to the interest of the several years given, and it will give the answer.

(<sup>22</sup>) What is the interest of 554*l.* 10*s.* for 3 months, at 4 per cent. per annum?

$$\begin{array}{r} 554 \ 10 \\ 4 \end{array}$$

$$\begin{array}{r} 22 \ 18 \ 0 \\ 20 \end{array}$$

$$\begin{array}{r} 3 \ 60 \\ 12 \end{array}$$

$$\begin{array}{r} m. \ 7 \ 20 \\ 3 \ \frac{1}{4} \ 22 \ 3 \ 7 \end{array}$$

$$Ans. \ \underline{\underline{5 \ 10 \ 10\frac{3}{4}}}$$

(<sup>23</sup>) What is the interest of 336*l.* 15*s.* 6*d.* for  $2\frac{3}{4}$  years, at 5 per cent. per annum?

$$\begin{array}{r} 336 \ 15 \ 6 \\ 5 \end{array}$$

$$\begin{array}{r} 16 \ 83 \ 17 \ 6 \\ 20 \end{array}$$

$$\begin{array}{r} 16 \ 77 \\ 12 \end{array}$$

$$\begin{array}{r} 9 \ 30 \\ 4 \end{array}$$

$$\begin{array}{r} 1 \ 20 \end{array}$$

$$\begin{array}{r} \frac{1}{2} \ \frac{1}{2} \ 16 \ 16 \ 9\frac{1}{4} \\ 2 \end{array}$$

$$\begin{array}{r} 3 \ 3 \ 13 \ 6\frac{1}{2} \\ \frac{1}{4} \ \frac{1}{2} \ 8 \ 8 \ 4\frac{1}{2} \\ 4 \ 4 \ 2\frac{1}{4} \end{array}$$

$$Ans. \ \underline{\underline{46 \ 6 \ 1\frac{1}{4}}}$$



(<sup>14</sup>) What is the interest of 325*l.* 7*s.* 6*d.* at 6 per cent. per annum, for three years and a half? *Ans.* £68 : 6 : 6 $\frac{1}{4}$ .

(<sup>15</sup>) What is the interest of 547*l.* 2*s.* 4*d.* for five years and a half, at 4 per cent. per annum? *Ans.* £120 : 7 : 3 $\frac{1}{4}$ .

(<sup>16</sup>) What is the interest of 257*l.* 5*s.* 1*d.* at 4 per cent. for a year and three quarters? *Ans.* £18 : 0 : 1 $\frac{1}{2}$ .

(<sup>17</sup>) What is the interest of 479*l.* 5*s.* for 5 years and one quarter, at 5 per cent. per annum? *Ans.* £125 : 16 : 0 $\frac{3}{4}$  qrs.

When the rate per cent. is  $\frac{1}{4}$ ,  $\frac{1}{2}$ , or  $\frac{3}{4}$  more than the pounds given in the rate, proceed as in commission, and it will give the answer for one year; and for several, proceed as in the last rule.

(<sup>18</sup>) What is the interest of 175*l.* 17*s.* for 2 year and 3 quarters, at 4 $\frac{1}{2}$  per cent. per annum?

$$\begin{array}{r} \frac{1}{2} \frac{1}{2} \quad 175 : 17 \\ \hline 4 \end{array}$$

$$\begin{array}{r} 703 : 8 : 0 \\ 87 : 18 : 6 \\ \hline \end{array}$$

$$\begin{array}{r} 7|91 : 6 : 6 \\ 20 \end{array}$$

$$\begin{array}{r} 18|26 \\ 12 \end{array}$$

$$\begin{array}{r} 3|18 \\ \hline \end{array}$$

$$\begin{array}{r} \frac{1}{2} \frac{1}{2} \quad 7 : 18 : 3 \\ \hline 2 \end{array}$$

$$15 : 16 : 6$$

$$\begin{array}{r} \frac{1}{4} \frac{1}{2} \quad 3 : 19 : 1\frac{1}{2} \\ 1 : 19 : 6\frac{3}{4} \\ \hline \end{array}$$

$$\text{Ans. } \underline{\underline{\underline{\pounds 21 : 15 : 2\frac{1}{4}}}}}$$

(<sup>19</sup>) What is the interest of 39*l.* 9*s.* 5*d.* for 2 years and 1 quarter, at 3 $\frac{1}{2}$  per cent. per annum? *Ans.* £31 : 6*s.*

(<sup>20</sup>) What is the interest of 570*l.* 2*s.* 7*d.* for 7 years and 1 quarter, at 4 $\frac{1}{2}$  per cent. per annum? *Ans.* £187 19 : 1 $\frac{1}{2}$ .

(<sup>21</sup>) What is the interest of 279*l.* 13*s.* 8*d.* at 5 $\frac{1}{4}$  per cent. per annum, for 3 years and a half? *Ans.* £51 : 7 : 10.

*When the interest is required for any number of weeks.*

**RULE.** As 52 weeks are to the interest of the given sum for a year; so are the weeks given, to the interest required.

G

(<sup>21</sup>) What

(40) What principal being put to interest will amount to 402*l.* 10*s.* in 5 years, at 3 per cent. per annum?

$$3 \times 5 + 100 = £115 : 100 :: 402 \dots 10$$

$$\begin{array}{r} 20 \qquad 20 \\ \hline 2300 \qquad 8050 \\ \hline 100 \end{array}$$

$$23|00)8050|00$$

Ans. £350.

(41) What principal being put to interest for 9 years will amount to 734*l.* 8*s.* at 4 per cent. per annum? Ans. £540.

(42) What principal being put to interest for 7 years, at 5 per cent. per annum, will amount to 334*l.* 16*s.*? Ans. £248.

When the principal, rate per cent. and amount are given, to find the time.

RULE. As the interest of the principal is to one year, so is the whole interest to the time required.

(43) In what time will 350*l.* amount to 402*l.* 10*s.* at 3 per cent. per annum?

$$\begin{array}{r} 350 \qquad \text{As } 10 \dots 10 : 1 :: 52 \dots 10 : 5 \\ 3 \qquad 20 \qquad 20 \end{array}$$

$$\begin{array}{r} 10|50 \qquad 210 \ 21|0)105|0 \text{ (5 years Ans. } £402 : 10 \\ 20 \qquad 105 \\ \hline 350 : 0 \end{array}$$

$$10|00 \qquad \dots \qquad 52 : 10$$

(44) In what time will 540*l.* amount to 734*l.* 8*s.* at 4 per cent. per annum? Ans. 9 years.

(45) In what time will 248*l.* amount to 334*l.* 16*s.* at 5 per cent. per annum? Ans. 7 years.

When the principal, amount, and time are given, to find the rate per cent.

RULE. As the principal is to the interest for the whole time, so is 100*l.* to the interest for the same time. Divide that interest by the times and the quotient will be the rate per cent.

(46) At

(46) At what rate *per cent.* will 350*l.* amount to 402*l.* 10*s.* in 5 years time?

As 350 : 52 : 100 : 15

20

1050

100

402 : 10

350 : 0

Interest 52 : 10

35|0 10500|0 (300*s.* £15 ÷ 5 = 3 *per cent.*

(47) At what rate *per cent.* will 248*l.* amount to 334*l.* 16*s.* in 7 years time?

Ans. 5 *per cent.*

(48) At what rate *per cent.* will 540*l.* amount to 734*l.* 8*s.* in 9 years time?

Ans. 4 *per cent.*

### COMPOUND INTEREST

Is that which arises both from the principal and interest: that is, when the interest on money becomes due, and not paid, the same interest is allowed on that interest unpaid, as was on the principal before.

RULE 1. Find the first year's interest, which add to the principle, then find the interest of that sum, which add as before; and so on for the number of years.

2. Subtract the given sum from the last amount, and it will give the compound interest required.

#### EXAMPLES.

(1) What is the compound interest of 500*l.* forborne 3 years, at 5 *per cent. per annum*?

500	500	525
5	25	26 : 5

25 00	525 1 <sup>st</sup> year.	551 : 5 2 <sup>d</sup> year.
	5	5

26 25	27 56 : 5	551 : 5
20	20	27 : 11 : 3

5 00	11 25	578 : 16 : 3 3 <sup>d</sup> year.
	12	500 : 0 : 0 prin. sub.

£78 : 16 : 3 = interest  
for 3 years.

(2) What is the amount of 400*l.* forborne 3½ years, at 6 *per cent. per ann. compound interest*? Ans. £490 : 13 : 11½.

G 3

(3) What

(3) What will 650*l.* amount to in 5 years, at 5 per cent. per annum, compound interest? *Ans.* £829 : 11 : 7½.

(4) What is the amount of 550*l.* 10*s.* for three years and 6 months, at 6 per cent per annum, compound interest?

*Ans.* £675 : 6 : 5.

(5) What is the compound interest of 764*l.* for 4 years, and 9 months, at 6 per cent. per annum? *Ans.* £243 : 18 : 8.

(6) What is the compound interest of 57*l.* 10*s.* 6*d.* for 5 years, 7 months, and 15 days, at 5 per cent. per annum?

*Ans.* £18 : 3 : 10¾.

(7) What is the compound interest of 259*l.* 10*s.* for 3 years 9 months, and 10 days, at 4½ per cent. per annum?

*Ans.* £47 : 0 : 4¾.

### REBATE or DISCOUNT

**I**S the abating so much money on a debt to be received before it is due, as that money, if put to interest, would gain in the same time, and at the same rate. -As 100*l.* present money will discharge a debt of 105*l.* to be paid a year to come, rebate being made at 5 per cent.

**RULE.** As 100*l.* with the interest for the time given, is to that interest, so is the sum given to the rebate required.

Subtract the rebate from the given sum, and the remainder will be the present worth.

#### EXAMPLES.

(1) What is the discount and present worth of 487*l.* 12*s.* for 6 months, at 6 per cent. per annum?

6m. ½)6      As 103 : 3 :: 487 : 12

20                      20

3

100

2060

9752

3

103

206|0)2925|6(14*l.* 4*s.* rebate.

487 : 12

206

14 : 4

865

*Ans.* £473 : 8 present worth 824

416 = 4*s.*

(2) What



(<sup>1</sup>) What is the present payment of 357*l.* 10*s.* which was agreed to be paid 9 months hence, at 5 per cent. per ann. ?

Ans. £344 : 11 : 7.

(<sup>2</sup>) What is the discount of 275*l.* 10*s.* for 7 months, at 5 per cent. per annum ?

Ans. £7 : 16 : 1 $\frac{3}{4}$ .

(<sup>4</sup>) Bought goods to the value of 109*l.* 10*s.* to be paid at 9 months—what present money will discharge the same, if I am allowed 6 per cent. per annum discount ?

Ans. £104 : 15 : 8 $\frac{1}{4}$ .

(<sup>5</sup>) What is the present worth of 527*l.* 9*s.* 1*d.* payable 7 months hence, at 4 $\frac{1}{2}$  per cent. ?

Ans. £514 : 13 : 10 $\frac{1}{2}$ .

(<sup>6</sup>) What is the discount of 85*l.* 10*s.* due September the 8th, this being July the 4th, rebate at 5 per cent. per ann. ?

Ans. 15*s.* 3 $\frac{1}{2}$ .

(<sup>7</sup>) Sold goods for 875*l.* 5*s.* 6*d.* to be paid 5 months hence—what is the present worth at 4 $\frac{1}{2}$  per cent. ?

Ans. £859 : 15 : 11 $\frac{1}{2}$ .

(<sup>8</sup>) What is the present worth of 500*l.* payable in 10 months, at 5 per cent. per annum ?

Ans. £480.

(<sup>9</sup>) How much ready money can I receive for a note of 75*l.* due 15 months hence, at 5 per cent. ?

Ans. £70 : 11 : 9.

(<sup>10</sup>) What will be the present worth of 150*l.* payable at three 4 months ; *i. e.* one third at 4 months, one third at 8 months, and one third at 12 months, at 5 per cent. discount ?

Ans. £145 : 3 : 8 $\frac{1}{2}$ .

(<sup>11</sup>) Sold goods to the value of 575*l.* 10*s.* to be paid at two 3 months—what must be discounted for the present payment at 5 per cent. ?

Ans. £10 : 11 : 4 $\frac{3}{4}$ .

(<sup>12</sup>) What is the present worth of 500*l.* at 4 per cent. 10*l.* being to be paid down, and the rest at two 6 months ?

Ans. £488 : 7 : 8 $\frac{1}{2}$ .

## EQUATION OF PAYMENTS

**I**S, when several sums are due at different times, to find a mean time for paying the whole debt ; to do which this is the common

**RULE.** Multiply each payment by its time of continuance, and divide the sum of the products by the whole debt, the quotient is accounted the mean time

EXAMPLES.

## EXAMPLES.

(<sup>1</sup>) A owes B 200*l.* whereof 40*l.* is to be paid at 3 months, 60*l.* at 5 months, and 100*l.* at 10 months; at what time may the whole debt be paid together, without prejudice to either?

<i>£.</i>		<i>m.</i>		
40	×	3	=	120
60	×	5	=	300
100	×	10	=	1000

---


$$2|00)14|20$$


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$$7 \text{ months, } \frac{1}{10}.$$


---

(<sup>2</sup>) B owes C 800*l.* whereof 200*l.* is to be paid at 3 months, 100*l.* at 4 months, 300*l.* at 5 months, and 200*l.* at 6 months; but they agreeing to make but one payment of the whole—I demand what that time must be?

*Ans.* 4 months,  $17\frac{1}{2}$  days.

(<sup>3</sup>) I bought of K a quantity of goods to the value of 360*l.* which was to have been paid as follows; 120*l.* at 2 months, 200*l.* at 4 months, and the rest at 5 months; but we afterwards agreed to have it paid at one mean time—the time is demanded?

*Ans.* 3 months,  $12\frac{2}{3}$  days.

(<sup>4</sup>) A merchant bought goods to the value of 500*l.* to pay 100*l.* at the end of 3 months, 150*l.* at the end of 6 months, and 250*l.* at the end of 12 months; but afterwards they agreed to discharge the debt at one payment; at what time was this payment made? *Ans.* 8 months,  $11\frac{1}{3}$  days.

(<sup>5</sup>) H is indebted to L a certain sum, which is to be paid at 6 different payments, that is,  $\frac{1}{4}$  at 2 months,  $\frac{1}{8}$  at 3 months,  $\frac{1}{8}$  at 4 months,  $\frac{1}{4}$  at 5 months,  $\frac{1}{8}$  at 6 months, and the rest at 7 months; but they agree that the whole shall be paid at one equated time—what is that time?

*Ans.*  $4\frac{1}{4}$  months.

(<sup>6</sup>) A is indebted to B 120*l.* whereof  $\frac{1}{2}$  is to be paid at 3 months,  $\frac{1}{4}$  at 6 months, and the rest at 9 months—what is the equated time of the whole payments?

*Ans.* 5 months, 7 days.

BARTER.

## BARTER

**I**S the exchanging one commodity for another, and informs the traders so to proportion their goods, that neither may sustain loss.

**RULE 1<sup>st</sup>,** Find the value of that commodity whose quantity is given; then find what quantity of the other, at the rate proposed, you may have for the same money.

**2<sup>dy</sup>,** When one has goods at a certain price, *ready money*, but in bartering advances it to something more, find what the other ought to rate his goods at, in proportion to that advance, and then proceed as before.

## EXAMPLES.

1 What quantity of chocolate, at 4s. *per lb.* must be delivered in barter for 2 cwt. of tea, at 9s. *per lb.*?

$$\begin{array}{r}
 2 \text{ cwt.} \\
 112 \\
 \hline
 224 \\
 9 \\
 \hline
 4)2016 \text{ the value of the tea.} \\
 \hline
 504 \text{ lb. of chocolate.} \\
 \hline
 \hline
 \end{array}$$

2. A and B barter; A hath 20 cwt. of prunes, at 4d. *per lb.* ready money, but in barter will have 5d. *per lb.* and B hath hops worth 32s. *per cwt.* ready money; what ought B to rate his hops at in barter, and what quantity must be given for the 20 cwt. of prunes?

$$\begin{array}{r}
 112 \text{ As } 4:5::32 \\
 20 \qquad 5 \\
 \hline
 s. \qquad \hline
 40 \quad 2240 \quad 4)160 \\
 12 \qquad 5 \quad \hline
 \hline
 \text{cwt. gr. lb. } 40 \text{ S.} \\
 48|0)1120|0(23:1:9\frac{1}{8} \text{ Ans.} \\
 96 \\
 \hline
 160 \\
 144 \\
 \hline
 16 = 1 \text{ gr. } 9\frac{1}{8} \text{ lb.} \\
 \hline
 \hline
 \end{array}$$

3 How

(3) How much tea, at  $9s.$  *per lb.* can I have in barter for 4 cwt. 2 qrs. of chocolate, at  $4s.$  *per lb.*? *Ans.* 2 cwt.

(4) Two merchants barter; A hath 20 cwt. of cheese, at  $21s.$   $6d.$  *per cwt.* B hath eight pieces of Irish cloth, at  $3l.$   $14s.$  *per piece*—I desire to know who must receive the difference, and how much?

*Ans.* B must receive of A  $£8 : 2s.$

(5) A and B barter; A hath  $3\frac{1}{2}$  lb. of pepper, at  $13\frac{1}{4}d.$  *per lb.* B hath ginger at  $15\frac{1}{4}d.$  *per lb.*—how much ginger must be delivered in barter for the pepper? *Ans.*  $3lb.$   $1\frac{3}{4}oz.$

(6) How many dozen of candles, at  $5s.$   $2d.$  *per dozen*, must be delivered in barter for 3 cwt. 2 qrs.  $16lb.$  of tallow, at  $37s.$   $4d.$  *per cwt.* *Ans.* 26 doz.  $3\frac{5}{8}lb.$

(7) A hath 608 yards of cloth, worth  $14s.$  *per yard*, for which B gives him  $125l.$   $12s.$  in ready money, and 85 cwt. 2 qrs.  $24lb.$  of bees-wax. The question is—what did B reckon his bees-wax at *per cwt.*? *Ans.*  $£3 : 10s.$

(8) A and B barter; A hath 320 dozen of candles, at  $4s.$   $6d.$  *per dozen*, for which B gives him  $30l.$  in money, and the rest in cotton, at  $8d.$  *per lb.*—I desire to know how much cotton B gave A besides the money?

*Ans.* 11 cwt. 1 qr.

(9) If B hath cotton at  $1s.$   $2d.$  *per lb.*—how much must he give A for 114 lb. of tobacco, at  $6d.$  *per lb.*?

*Ans.*  $48\frac{1}{4}lb.$

(10) C hath nutmegs worth  $7s.$   $6d.$  *per lb.* ready money, but in barter will have  $8s.$  *per lb.* and D hath leaf-tobacco worth  $9d.$  *per lb.* ready money.—how much must D rate his tobacco at *per lb.* that his profit may be equivalent with C's?

*Ans.*  $9\frac{1}{2}d.$   $\frac{3}{8}$

## PROFIT and LOSS

IS a rule that discovers what is got or lost in the buying or selling of goods; and instructs us to rise or fall our price, so as to gain or lose so much *per cent.* or otherwise.

The questions in this rule are performed by the Rule of Three.

## EXAMPLES.



EXAMPLES.

(1) If a yard of cloth is bought for 11s. and sold for 12s. 6d.—what is the gain per cent.?

As 11:100::6:100

12 20

18 2000

18

1200 6

1100 11)36000

100 6 12)3272

20)272:8

Ans. £. 13 : 12 : 8  $\frac{8}{11}$ .

(2) If 60 ells of Holland cost 18l.—what must 1 ell be sold for to gain 8 per cent.?

As 100:18::108

108

12 × 5 = 60

100)1944

20)12)1900 8  $\frac{1}{2}$

80 5)100 12 4  $\frac{3}{4}$

12

60 5  $\frac{3}{4}$

90 60

4

20 40

Ans. 6s. 5  $\frac{3}{4}$ .

(3) If 1 lb. of tobacco cost 16d. and is sold for 20d.—what is the gain per cent.?

Ans. £ 25.

(4) If a parcel of cloth be sold for 560l. and at 12 per cent. gain—what was the prime cost?

Ans. £ 500

(5) If a yard of cloth is bought for 13s. 4d. and sold again for 16s.—what is the gain per cent.?

Ans. £ 20.

(6) If 112 lb. of iron cost 27s. 6d.—what must 1 cwt. be sold for to gain 15l. per cent.?

Ans. £ 1 : 11 : 7  $\frac{1}{2}$ .

(7) If 375 yards of broad cloth be sold for 490l. and 20 per cent. profit—what did it cost per yard?

Ans. £ 1 : 1 : 9  $\frac{1}{4}$ .

(8) Sold 1 cwt. of hops for 60l. 15s. at the rate of 25 per cent. profit.—what would have been the gain per cent. if I had sold them for 80l. per cwt.

Ans. £ 64 : 12 : 2.

(9) If 90 Eng. ells of cambric cost 60l.—how must I sell it at per yard to gain 18l. per cent.?

Ans. 12s. 7d. +

(10) A plumber sold 10 fother of lead for 204l. 15s. (the fother being 19  $\frac{1}{2}$  cwt.) and gained after the rate of 12l. 10s. per cent. what did it cost him per cwt.?

Ans. 18s. 8d.

(11) Bought 436 yards of cloth, at the rate of 8s. 6d. per yard, and sold it for 10s. 4d. per yard—what was the gain of the whole?

Ans. £ 39 : 19 : 4

(12) Paid 69l. for 1 ton of steel, which is retailed at 6d. per lb.—what is the profit or loss by the sale of 14 tons?

Ans. £ 182 loss.

(13) Bought 124 yards of linen for 32*l*.—how should the same be retailed *per* yard to gain 15*l*. *per cent.*?

*Ans.* 5*s*. 11 $\frac{23}{24}$ .

(14) Bought 249 yards of cloth, at 3*s*. 4*d*. *per* yard, retailed the same at 4*s*. 2*d*. *per* yard—what is the profit in the whole, and how much *per cent.*?

*Ans.* £10 : 7 : 6 profit, and 25 *per cent.*

## FELLOWSHIP

**I**S when two or more join their stocks and trade together so to determine each person's particular share of the gain or loss, in proportion to his principal in the joint-stock.

*By this rule a bankrupt's estate may be divided amongst his creditors : as also legacies may be adjusted when there is a deficiency of assets or effects.*

FELLOWSHIP is either with or without TIME.

## FELLOWSHIP WITHOUT TIME.

**RULE,** As the whole stock is to the whole gain or loss, so is each man's share in stock, to his share of the gain or loss.

**PROOF.** Add all the shares together, and the sum will be equal to the given gain or loss; but the surest way is, as the whole gain or loss is to the whole stock, so is each man's share of the gain or loss to his share in stock.

### EXAMPLES.

(1) Two merchants trade together; A put into stock 20*l*. and B 40*l*. they gained 50*l*.—what is each person's share thereof.

$20 + 40 = 60$       £. s. d.  
As 60 : 50 :: 20      As 60 : 50 :: 40      33 : 6 : 8 B's share  
20      40      16 : 13 : 4 A's.

6|0)100|0

6|0)200|0

50 : 0 : 0 Proof.

£16 : 13 : 4

£33 : 6 : 8

(2) Three merchants trade together, A, B, and C; A puts in 20*l*. B 30*l*. and C 40*l*. they gained 180*l*.—what is each man's part of the gain? *Ans.* A £40; B £60; C £80.

(3) A, B, and C. enter into partnership: A puts in 364*l.* B 482*l.* and C 500*l.* and they gained 867*l.*—what is each man's share in proportion to his stock?

*Ans.* A £234:9:3 $\frac{1}{2}$ —*em.* 70; B £310:9:5—*rem.* 2485.  
C £322:1:3 $\frac{1}{2}$ —*r. m.* 1028

(4) Four merchants, B, C, D, and E, made a stock; B put in 227*l.* C 349*l.* D 115*l.* and E 439*l.* in trading they gained 428*l.*—I demand each merchant's share of the gain?

*Ans.* B's £85:19:6 $\frac{1}{2}$ —690; C's £132:3:9—120;  
D's £43:11:1 $\frac{1}{4}$ —250; E's £166:5:6 $\frac{1}{4}$ —0.

(5) Three persons, D, E, and F, join in company: D's stock was 750*l.* E's 460*l.* and F's 500*l.* and at the end of 12 months they gained 68*l.*—what is each man's particular share of the gain? *Ans.* D £300; E £184; and F £200.

(6) A merchant is indebted to B 275*l.* 14*s.*; to C 304*l.* 7*s.*; to D 152*l.*; and to E 104*l.* 6*s.*; but upon his decease his estate is found to be worth but 675*l.* 15*s.*—how must it be divided among his creditors?

*Ans.* B's £222:15:2—6584; C's £245:18:1 $\frac{1}{2}$ —5750;  
D's £122:16:2 $\frac{1}{2}$ —2227; and E's £84:5:5—15620.

(7) Four persons trading together, in a joint stock, of which A has  $\frac{1}{3}$ , B  $\frac{1}{4}$ , C  $\frac{1}{5}$ , and D  $\frac{1}{6}$ , and at the end of 6 months they gain 100*l.*—what is each man's share of the said gain? *Ans.* A's £35:1:9—48. B' £26:6:3 $\frac{3}{4}$ —36;  
C's £21:1:0 $\frac{1}{2}$ —120; and D's £17:10:10 $\frac{1}{2}$ —24.

(8) Two persons purchased an estate of 1700*l.* *per annum*, freehold, for 27200*l.* when money was at 6 *per cent.* interest, and 4*s.* *per* pound land-tax, whereof D paid 15000*l.* and E the rest; sometime after the interest of, the money falling to 5 *per cent.* and 2*s.* *per* pound land-tax, they sell the said estate for 24 year's purchase—I desire to know each persons share? *Ans.* D's £22500; E's £18300.

(9) D, E, and F, join their stock in trade; the amount of their stock is 647*l.* and are in proportion as 4, 6, and 8, are to one another, and the amount of their gain is equal to D's stock—what is each man's stock and gain?

D's stock, £143:15:6 $\frac{1}{2}$  gain, £31:19:0. 207040.

E's — 215:13:4 — 47:18:6 310560.

F's — 287:11:1 $\frac{1}{2}$  — 63:08:0. 414080.

(10) D, E, and F, join stocks in trade: The amount of their stocks was 100*l.* D's gain 3*l.* E's 5*l.* and F's 8*l.*—what is each man's stock?

*Ans.* D's stock £18:15; E's £31:5; and F's £50.

## FELLOWSHIP WITH TIME.

**RULE.** As the sum of the products of each man's money and time is to the whole gain or loss, so is each man's product to his share of the gain or loss.

**PROOF.** As in Fellowship Without Time.

## EXAMPLES.

(1) D and E enter into partnership; D puts in 40*l.* for 3 months, and E 75*l.* for 4 months, and they gained 70*l.* what is each man's share of the gain?

*Ans* D's £20 · E's £50.

$$\begin{array}{rcl}
 40 \times 3 = 120 & \text{As } 420:70::120 & \text{As } 420:70::300 \\
 75 \times 4 = 300 & \quad \quad \quad 120 & \quad \quad \quad 300 \\
 \hline & 420 & 42|0)840|0(20 \quad 42|0)2100|0(50 \\
 & & \quad \quad \quad 84 \quad \quad \quad 2100 \\
 & & \hline & & \hline
 \end{array}$$

(2) Three merchants join in company; D puts in stock 195*l.* 14*s.* for 3 months, E 179*l.* 18*s.* 3*d.* for 5 months, and F 59*l.* 14*s.* 10*d.* for 11 months, they gained 364*l.* 18*s.* what is each man's part of the gain?

*Ans* D's £99:18:7 $\frac{1}{4}$ —75455; E's £153:2:3 $\frac{1}{2}$ —28250; and F's £111:17:1—40812.

(3) Three merchants join in company for 18 months; D put in 500*l.* and at 5 months end took out 200*l.* at 10 months end put in 300*l.* and at the end of 14 months took out 130*l.* E puts in 400*l.* and at the end of 3 months 270*l.* more; at 9 months he takes out 140*l.* but puts in 100*l.* at the end of 12 months, and withdraws 99*l.* at the end of 15 months. F puts in 900*l.* and at 6 months took out 200*l.*; at the end of 11 months, puts in 500*l.* but takes out that and 100*l.* more at the end of 13 months. They gained 200*l.*—I desire to know each man's share of the gain?

*Ans* D's £50:7:6—21720; E's £62:12:5 $\frac{1}{4}$ —29859; and F's £87:0:0 $\frac{1}{4}$ —14167.

(4) D, E, and F, hold a piece of ground in common, for which they are to pay 36*l.* 10*s.* 6*d.* D puts in 23 oxen 27 days; E 21 oxen 35 days; and F 16 oxen 23 days;—what is each man to pay of the said rent?

*Ans* D's £13:3:1 $\frac{1}{2}$ —624, E's £15:11:5—1688; and F's £1:15:11—1136.



## ALLIGATION.

ALLIGATION is either MEDIAL or ALTERNATE.

## ALLIGATION MEDIAL

Is when the price and quantities of several simples are given to the mixed, to find the mean price of that mixture.

RULE. As the whole composition is to its total value, so is any part of the composition to its mean price.

PROOF. Find the value of the whole mixture at the mean rate, and if it agrees with the total value of the several quantities at their respective prices, the work is right.

## EXAMPLES.

(1) A farmer mixed 20 bushels of wheat, at 5*s.* per bushel, and 36 bushels of rye, at 3*s.* per bushel, with 40 bushels of barley, at 2*s.* per bushel—I desire to know the worth of a bushel of this mixture?

$$20 \times 5 = 100$$

$$36 \times 3 = 108$$

$$40 \times 2 = 80$$

$$\text{---}$$

$$\underline{\underline{96}} \quad \underline{\underline{288}}$$

$$\text{As } 96:288::1:3$$

Ans. 3*s.*

(2) A vintner mingles 15 gallons of Canary, at 8*s.* per gallon, with 20 gallons, at 7*s.* 4*d.* per gallon, 10 gallons of Sherry, at 6*s.* 8*d.* per gallon, and 24 gallons of white wine at 4*s.* per gallon—what is the worth of a gallon of this mixture?

$$\text{Ans. } 6\text{s. } 2\frac{1}{2}\text{d. } \frac{4}{5}\text{d.}$$

(3) A grocer mingled 4 cwt. of sugar, at 56*s.* per cwt. 7 cwt. at 43*s.* per cwt. and 5 cwt. at 37*s.* per cwt.—I demand the price of 2 cwt. of this mixture?

$$\text{Ans. } \text{£}4:8:9.$$

(4) A maltster mingles 30 quarters of brown malt, at 28*s.* per quarter, with 46 quarters of pale, at 30*s.* per quarter, and 24 quarters of high dried ditto, at 25*s.* per quarter—what is the value of 8 bushels of this mixture?

$$\text{Ans. } \text{£}1:8:2\frac{1}{4}\text{d. } \frac{6}{16}.$$

(5) If I mix 27 bushels of wheat, at 5*s.* 6*d.* per bushel, with the same quantity of rye, at 4*s.* per bushel, and 14 bushels of barley, at 2*s.* 8*d.* per bushel—what is the worth of a bushel of this mixture?

$$\text{Ans. } 4\text{s. } 3\frac{1}{4}\text{d. } \frac{2}{8}\text{d.}$$

(6) A grocer mingled 3 cwt. of sugar, at 56s. per cwt. 6 cwt. at 1*l*. 17s. 4*d*. per cwt. and 3 cwt. at 3*l*. 14s. 8*d*. per cwt.—what is 1 cwt. of this mixture worth? *Ans.* £2:11:4.

(7) A mealman has flour of several sorts, and would mix 3 bushels at 3s. 5*d*. per bushel, 4 bushels at 5s. 6*d*. per bushel, and 5 bushels at 4s. 8*d*. per bushel—what is the worth of a bushel of this mixture? *Ans.* 4s. 7½*d*. ⅔.

(8) A vintner mixes 20 gallons of Port, at 5s. 4*d*. per gallon with 12 gallons of white wine, at 5s. per gallon, 30 gallons of Lisbon, at 6s. per gallon, and 20 gallons of Mount-ain, at 4s. 6*d*. per gallon—what is a gallon of this mixture worth? *Ans.* 5s. 3¾*d*. ⅝.

(9) A farmer mingled 20 bushels of wheat at 5*s*. per bushel, and 36 bushels of rye, at 3*s*. per bushel, with 40 bushels of barley, at 2*s*. per bushel—I desire to know the worth of a bushel of this mixture? *Ans.* 3*s*.

(10) A person mixing a quantity of oats, at 2*s*. 6*d*. per bushel, with the like quantity of beans, at 4*s*. 6*d*. per bushel—would be glad to know the price of one bushel of that mixture? *Ans.* 3*s*. 6*d*.

(11) A refiner having 12lb. of silver bullion, of 6oz. fine, would melt it with 8lb. of 7oz. fine, and 10lb. of 8oz. fine—I require the fineness of 1lb. of that mixture? *Ans.* 6oz. 18dwt. 16grs.

(12) If with 40 bushels of corn, at 4*s*. per bushel, there are mixed 10 bushels at 6*s*. per bushel, 30 bushels at 5*s*. per bushel, and 20 bushels at 3*s*. per bushel—what will 10 bushels of that mixture be worth? *Ans.* £2:3*s*.

(13) A tobacconist would mix 50lb. of tobacco, at 1*l*. *d*. per lb. with 30lb. at 14*d*. per lb. 25lb. at 22*d*. per lb. and 37lb. at 2*s*. per lb.—what will 1lb. of this mixture be worth? *Ans.* 16¾*d*. ⅓.

### ALLIGATION ALTERNATE

Is when the prices of several things are given, to find such quantities of them to make a mixture, that may bear a price pre-pounded.

*In ordering the rates and given price, observe,*

(1) Place them one under the other, and the pre-pounded price or mean rate at the left hand of them, thus,

18	2
20	6
22	
24	4
28	2

(2) Link the several rates together by 2 and 2; always observing to join a greater and a less than the mean.

3. Against each extreme place the difference of the mean and its yoke-fellow,

*When the prices of the several simples and the mean rate are given without any quantity, to find how much of each simple is required to compose the mixture.*

**RULE.** Take the difference between each price and the mean rate, and set them alternately, they will be the answer required.

**PROOF.** By Alligation Medial.

## EXAMPLES.

(1) A vintner would mix four sorts of wine together, of 18*d.* 20*d.* 24*d.* and 28*d.* per quart—what quantity of each must he take to sell the mixture at 22*d.* per quart?

Answer.	Proof.	Or thus	Proof.
18 ———	20 <i>d.</i> of 18 <i>d.</i> 36 <i>d.</i>	18 ———	60 <i>d.</i> of 18 <i>d.</i> = 108 <i>d.</i>
20 ———	60 <i>d.</i> of 20 <i>d.</i> 120	20 ———	20 <i>d.</i> of 20 <i>d.</i> = 40
22 ———	40 <i>d.</i> of 24 <i>d.</i> 96	24 ———	20 <i>d.</i> of 24 <i>d.</i> = 48
24 ———	20 <i>d.</i> of 28 <i>d.</i> 56	28 ———	40 <i>d.</i> of 28 <i>d.</i> = 112
28 ———			
14	)308	14	308
	<u>22<i>d.</i></u>		<u>22<i>d.</i></u>

*Note, Questions in this rule admit of a great variety of answers, according to the manner of linking them.*

(2) A grocer would mix sugar at 4*d.* 6*d.* and 10*d.* per lb. so as to sell the compound for 8*d.* per lb.—what quantity of each must he take? *Ans.* 2*lb.* at 4*d.*; 2*lb.* at 6*d.*; and 6*lb.* at 10*d.*

(3) I desire to know how much tea, at 16*s.* 14*s.* 9*s.* and 8*s.* per lb. will compose a mixture worth 10*s.* per lb.?

*Ans.* 1*lb.* at 16*s.*; 2*lb.* at 14*s.*; 6*lb.* at 9*s.*; and 4*lb.* at 8*s.*

(4) A farmer would mix as much barley at 3*s.* 6*d.* per bushel, rye at 4*s.* per bushel, and oats at 2*s.* per bushel, as to make a mixture worth 2*s.* 6*d.* per bushel—how much is that of each sort? *Ans.* 6 of barley; 6 of rye; and 30 of oats.

(5) A grocer would mix raisins of the sun at 7*d.* per lb. with Malagas at 6*d.* and Smyrnas at 4*d.* per lb.—I desire to know what quantity of each sort he must take to sell them at 5*d.* per lb.?

*Ans.* 1*lb.* of raisins of the sun; 1*lb.* of Malaga, and 3*lb.* Smyrnas.

(<sup>6</sup>) A tobacconist would mix tobacco of 2s. 18d. and 15d. per lb. so as the compound may bear a price of 1s. 8d. per lb.—what quantity of each must he take?

*Ans.* 7lb. at 2s. ; 4lb. at 1s. 6d. ; and 4lb. at 1s. 3d.

### ALLIGATION PARTIAL

Is when the prices of all the simples, the quantity of but one of them and the mean rate, are given to find the several quantities of the rest in proportion to that given.

**RULE.** Take the difference between each price, and the mean rate as before. Then,

As the difference of that simple, whose quantity is given is to the rest of the differences severally, so is the quantity given to the several quantities required.

#### EXAMPLES.

(<sup>1</sup>) A tobacconist being determined to mix 20lb. of tobacco, at 15d. per lb. with others at 16d. per lb. 18d. per lb. and 22d. per lb.—how many pounds of each sort must he take to make one pound of that mixture worth 17d.?

<i>Ans.</i>	<i>Proof.</i>	
15—	5	20lb. at 15d. = 300d.
16—	1	4lb. at 16d. = 64d.
17—	1	4lb. at 18d. = 72d.
22—	2	8lb. at 22d. = 176d.
	<u>36lb.</u> :	<u>612::1lb.:17d.</u>

(<sup>2</sup>) A farmer would mix 20 bushels of wheat at 60d. per bushel, with rye at 36d. barley at 24d. and oats at 18d. per bushel—how much must he take of each sort to make the composition worth 32d. per bushel?

*Ans.* 20 bushels of wheat ; 35 bushels of rye ; 70 bushels of barley ; and 10 bushels of oats.

(<sup>3</sup>) A person is desirous of mixing wheat at 4s. per bushel, rye at 3s. per bushel, and barley at 2s. per bushel, with 12 bushels of oats at 18d. per bushel—I would be glad to know how many bushels of each sort he must take, to make the composition worth 3s. 6d. per bushel?

*Ans.* 96 bushels of wheat ; 12 bushels of rye ; 12 of barley ; and 12 of oats.

(<sup>4</sup>) A distiller would mix 40 gallons of French brandy at 12s. per gallon, with English at 7s. and spirits at 4s. per



gallon—what quantity of each sort must he take, to afford it for 8*s.* per gallon?

*Ans.* 40 gallons French; 32 English; and 32 spirits.

(5) A grocer would mix teas of 12*s.* 10*s.* and 6*s.* with 20*lb.* at 4*s.* per lb.—how much of each sort must he take to make the composition worth 8*s.* per lb.

*Ans.* 20*lb.* at 4*s.*; 10*lb.* at 10*s.*; 10*lb.* at 6*s.*; and 20*lb.* at 12*s.*

(6) A wine merchant is desirous of mixing 18 gallons of Canary at 6*s.* 9*d.* per gallon, with Malaga at 7*s.* 6*d.* per gallon; Sherry at 5*s.* per gallon—and white wine at 5*s.* 3*d.* per gallon—how much of each sort must he take, that the mixture may be sold for 6*s.* per gallon?

*Ans.* 18 gallons of Canary; 13½ of Malaga; 13½ of Sherry, and 27 of white wine.

## ALLIGATION TOTAL

Is when the price of each simple, the quantity to be compounded and the mean rate, are given to find how much of each sort will make the quantity.

**RULE.** Take the difference between each price, and the mean rate as before; then,

As the sum of the differences is to each particular difference, so is the quantity given to the quantity required.

### EXAMPLES.

(3) A grocer has four sorts of sugar, viz. 12*d.* 10*d.* 6*d.* and 4*d.* per lb. and would make a composition of 144*lb.* worth 8*d.* per lb.—I desire to know what quantity of each he must take?

12	—	4—48 at 12 <i>d.</i> = 576	As 12:4::144:48
10	—	2—24 at 10 <i>d.</i> = 240	As 12:2::144:24
6	—	2—24 at 6 <i>d.</i> = 144	
4	—	4—48 at 4 <i>d.</i> = 192	
		— — —	
		12 144	) 1152 (8 <i>d.</i>
		— — —	— — —

(2) A druggist having four sorts of tea, of 5*s.* 6*s.* 8*s.* and 9*s.* per lb. would have a composition of 87*lb.* worth 7*s.* per lb.—what quantity must there be of each?

*Ans.* 14½*lb.* of 5*s.*; 29*lb.* of 6*s.*; 29*lb.* of 8*s.*; and 14½*lb.* of 9*s.*

(<sup>4</sup>) A vintner had four sorts of wine, *viz.* white wine at 4s. per gallon; Flemish at 6s. per gallon; Malaga at 8s. per gallon; and Canary at 10s. per gallon; would make a mixture of 60 gallons, to be worth 5s. per gallon—what quantity of each must he take?

*Ans.* 45 gallons of white wine; 5 gallons of Flemish; 5 gallons of Malaga, and 5 gallons of Canary.

(<sup>4</sup>) A grocer having four sorts of currants, at 11s. 9d. 6d. and 4d. per lb. is desirous of making a composition of 240lb. worth 8d. per lb.—how much of each must he take?

*Ans.* 96lb. at 11s.; 48lb. at 9d.; 24lb. at 6d.; and 72lb. at 4d.

(<sup>5</sup>) A silversmith hath four sorts of gold, *viz.* of 24 carats fine, of 22, 20, and 15 carats fine; would make as much of each sort together, so as to have 42 oz. of 17 carats fine—how much must he take of each?

*Ans.* 4 of 24; 4 of 22; 4 of 20; and 30 of 15 carats fine.

(<sup>6</sup>) A druggist having some drugs of 8s. 5s. and 4s. per lb. made them into two parcels; one of the 28lb. at 6s. per lb. the other of 42lb. at 7s. per lb.—how much of every sort did he take for each parcel?

*Ans.* 12lb. of 8s.

*Ans.* 30lb. of 8s.

8lb. of 5s.

6lb. of 5s.

8lb. of 4s.

6lb. of 4s.

28lb. at 6s. per lb.

42lb. at 7s. per lb.

### POSITION; or, the RULE of FALSE

IS a rule that, by false or supposed numbers, taken at pleasure, discovers the true one required. It is divided into two parts; SINGLE and DOUBLE.

#### SINGLE POSITION.

Is, by using one supposed number; and working with it as the true one; you find the real number required, by the following

RULE. As the total of the errors is to the true total, so is the suppose number to the true one required.

PROOF. Add the several parts of them together, and if it agrees with the sum, it is right.

#### EXAMPLES.

(<sup>1</sup>) A schoolmaster being asked how many scholars he had, said, If I had as many, half as many, and one quarter as many more, I should have 88—how many had he? *Ans.* 32.

Suppose he had	40	As 110:88::40	32
as many -	40	40	32
half as many	20	<hr/>	16
$\frac{1}{4}$ as many -	10	110 0)352 0(32	8
<hr/>		33	<hr/>
110		<hr/>	88 proof.
<hr/>		22	<hr/>
		<hr/>	
		..	
		<hr/>	

(2) A person having about him a certain number of Portugal pieces, said, If the third, fourth, and sixth of them were added together, they would make 54—I desire to know how many he had? *Ans.* 72.

(3) A gentleman bought a chaise, horse, and harness, for 60*l*. the horse came to twice the price of the harness, and the chaise to twice the price of the horse and harness—what did he give for each?

*Ans.* horse £13:6:8; harness £6:13:4; chaise £40.

(4) A, B, and C, being determined to buy a quantity of goods which would cost them 120*l*. agreed among themselves, that B should have a third part more than A, and C a fourth part more than B;—I desire to know what each man must pay? *Ans.* A £30; B £40; C £50.

(5) A man overtaking a maid driving a flock of geese, said to her, How do you do, Sweetheart; where are you going with these 30 geese? No, Sir, said she, I have not 30; but if I had as many more, half as many more, and 5 geese besides, I should have 30—how many had she? *Ans.* 10.

(6) A person delivered to another a sum of money unknown, to receive the interest for the same at 6 per cent. per annum, simple interest, and at the end of 10 years received for principal and interest 300*l*.—what was the sum lent?

*Ans.* £187:10*s*.

## DOUBLE POSITION

Is by making use of two supposed numbers, and if both prove false, (as it generally happens) they are, with their errors, to be thus ordered.

RULE 1. Place each error against its respective position.

2 Multiply them cross-wise,

3. If the errors are alike, *i. e.* both greater, or both less than the given number, take their difference for a divisor, and the difference of the products for a dividend. But if unlike, take their sum for a divisor, and the sum of the products for a dividend, the quotient will be the answer.

## EXAMPLES.

(1) A, B, and C, would divide 200<sup>l</sup> among them, so that B may have 6% more than A, and C 8% more than B—how much must each have?

Suppose A had 40      Then suppose A had 60  
     then B — 46      then B must have 56  
     and C — 54      and C — 64

140 too little by 60	170 too little by 30.
sup. errors.	
40 <del>X</del> — 60	60 A
50 <del>X</del> — 30	66 B
3000      1200      60	74 C
1200      30 divisor.	200 proof.

310)1800

60 answer for A.

(2) A man had two silver cups of unequal weight, having one cover to both of 5 oz; now if the cover be put on the lesser cup, it will be double the weight of the greater cup, and set on the greater cup, it will be thrice as heavy as the lesser cup—what is the weight of each cup?

*Ans.* 3 ounces lesser, 4 greater.

(3) A, B, and C, playing at hazard together. the money staked was 156 guineas; but disagreeing, each seized as many as he could: A got a certain quantity; B as many as A and 16 more; and C the 6th part of both their sums—how many had each?

*Ans.* A 76; B 92; and C 28.

(4) A gentleman bought a house with a garden, and a horse in the stable, for 500<sup>l</sup>. now he paid 4 times the price of the horse for the garden, and 5 times the price of the garden for the house—what was the value of the house, garden, and horse separately.

*Ans.* horse £20; garden £80; and house £400.



(5) Three persons discours'd concerning their ages; says H, I am 30 years of age; says K, I am as old as H, and  $\frac{1}{4}$  of L; and says L, I am as old as you both. What was the age of each person? *Ans.* H 30; K 50; and L 80.

(6) D, E, and F, playing at cards, staked 324 crowns; but disputing about the tricks, each man took as many as he could: D got a certain number; E as many as D, and 15 more; and F got a fifth part of both their sums added together—how many did each get?

*Ans.* D 127 $\frac{1}{2}$  E 142 $\frac{1}{2}$ , and F 54.

(7) A, stealing apples, was taken by B, and to appease him gave him half of what he had, and B gives him back 10; going farther, he meets C, who took from him half of what he had left, and gives him back 4; after that meeting with D, he gives him half of what he had, and he returns him back 1. At last getting safe away, he finds he had 13 left—how many had he at first? *Ans.* 60.

(8) A gentleman going into a garden, meets with some ladies, and says to them, Good morning to you 10 fair maids. Sir, you mistake, answered one of them, we are not 10; but if we were twice as many more as we are, we should be as many above 10 as we are now under—how many were they? *Ans.* 5.

## EXCHANGE

**IS** the receiving money in one country for the same value paid in another.

The *par* of exchange is always fixed and certain, it being the intrinsic value of foreign money, compared with sterling; but the course of exchange rises and falls, upon various occasions.

### I. FRANCE.

They keep their accounts at Paris, Lyons, and Rouen, in livres, sols, and deniers, and exchange by the crown, = 4*s.* 6*d.* a *par*.

NOTE. 12 deniers make 1 *sol*.

20 *sols* — 1 *livre*.

3 *livres* — 1 *crown*.

To change French into Sterling.

RULE. As one crown is to the given rate, so is the French sum to the sterling required.

*To change Sterling into French.*

**RULE.** As the rate of exchange is to 1 crown, so is the sterling sum to the French required.

**EXAMPLES.**

(1) How many crowns must be paid at Paris, to receive in London 180*l.* exchange, at 4*s.* 6*d.* per crown?

$$\begin{array}{r}
 d. \text{ cr. } \text{£.} \\
 \text{As } 54:1::180: \\
 \hline
 240 \\
 \hline
 \text{crowns,} \\
 54)43200(800 \\
 \underline{432} \\
 \dots \\
 \hline
 \end{array}$$

(2) A merchant at Paris remits to his correspondent in London 800 crowns, at 4*s.* 6*d.* each what is the value in sterling.

$$\begin{array}{r}
 cr. d. \text{ cr.} \\
 \text{As } 1:54::800: \\
 \hline
 54 \\
 \hline
 12)43200 \\
 \hline
 2|0|360|0 \\
 \hline
 180\text{£}
 \end{array}$$

(3) How much sterling must be paid in London, to receive in Paris 758 crowns, exchange, at 56*d.* per crown?

*Ans.* £176:17:4.

(4) A merchant in London remits 176*l.* 17*s.* 4*d.* to his correspondent at Paris—what is the value in French crowns, at 56*d.* per crown?

*Ans.* 758.

(5) Change 725 crowns 17 sols, 7 deniers, at 54½*d.* per crown, into sterling—what is the sum?

*Ans.* £164:14:0½.

(6) Change 164*l.* 14*s.* 0½*d.* sterling into French crowns, exchange at 54½*d.* per crown?

*Ans.* 725 crowns, 17 sols, 7 deniers.

**II. SPAIN.**

They keep their accounts at Madrid, Cadiz, and Seville, in dollars, rials, and marvedies, and exchange by the piece of eight=4*s.* 6*d.* at *par*.

**NOTE.** 34 *marvedies* make 1 *rial*.

8 *rials* — 1 *piastre*, or piece of eight.

10 *rials* — 1 *dollar*.

**RULE.** As with France.

**EXAMPLES.**

(7) A merchant at Cadiz remits to London 2547 pieces of eight, at 56*d.* per piece—how much sterling is the sum?

*Ans.* £594:6*s.*

(<sup>8</sup>) How many pieces of eight, at 56*d.* each, will answer a bill of 594*l.* 6*s.* sterling. *Ans.* 2547.

(<sup>9</sup>) I pay a bill here of 2500*l.*—what Spanish money may I draw my bill for at Madrid, exchange at 57½*d.* per piece of eight? *Ans.* 10434 pieces of eight, 6 rials, 8⅔ mar.

## III. ITALY.

They keep their accounts at Genoa and Leghorn in livers, sols, and deniers, and exchange by the piece of eight, or dollar = 4*s.* 6*d.* at par.

NOTE. 12 deniers make 1 sol.

20 sols — 1 livre.

5 livres — 1 piece of eight, at Genoa.

6 livres — 1 piece of eight, at Leghorn.

☞ The exchange at Florence is by Ducatoons; the exchange at Venice by Ducats.

NOTE. 6 solidi make 1 gross.

24 grossis — 1 ducat.

RULE. The same as before.

(<sup>10</sup>) How much sterling money may a person receive in London, if he pays in Genoa 976 dollars, at 53*d.* per dollar? *Ans.* £215 : 10 : 8.

(<sup>11</sup>) A merchant remitted 215*l.* 10*s.* 8*d.* sterling to Leghorn—how many dollars will he receive there, the exchange being at 53*d.* per dollar? *Ans.* 976.

(<sup>12</sup>) A factor hath sold goods at Florence, for 250 ducatoons, at 54*d.* each—what is the value in pounds sterling? *Ans.* £56 : 5*s.*

(<sup>13</sup>) A bill of 56*l.* 5*s.* is remitted to Florence to be paid in ducatoons, at 54*d.* each—how many will be received? *Ans.* 250.

(<sup>14</sup>) If 275 ducats, at 4*s.* 5*d.* each, be remitted from Venice to London—what is the value in pounds sterling? *Ans.* £60 : 14 : 7.

(<sup>15</sup>) A gentleman travelling, would exchange 60*l.* 14*s.* 7*d.* sterling for Venice ducats, at 4*s.* 5*d.* each—how many must he receive? *Ans.* 275.

## IV. PORTUGAL.

They keep their accounts at Oporto and Lisbon in reas, and exchange on the milrca = 6*s.* 8½*d.* at par.

NOTE. 1000 reas, make 1 milrca.

RULE. The same as with France.

## EXAMPLES.

(<sup>16</sup>) A gentleman being desirous to remit to his correspondent in London 2750 milreas, exchange at 6*s.* 5*d.* per milrea—how much sterling will he be creditor for in London?

*Ans.* £882 : 5 : 10*d.*

(<sup>17</sup>) If a bill be drawn from London of 882*l.* 5*s.* 10*d.* sterling—how many milreas, at 6*s.* 5*d.* each, is equal in value to the said sum?

*Ans.* 2750.

(<sup>18</sup>) A merchant at Oporto remits to London 4366 milreas, and 183 reas, at 5*s.* 5½*d.* exchange per milrea—how much sterling must be paid in London for this remittance?

*Ans.* £1193 : 17 : 6¾*d.*

(<sup>19</sup>) If I pay a bill at London of 1193*l.* 17*s.* 6¾*d.*—what must I draw for on my correspondent at Lisbon, exchange at 5*s.* 5½*d.* per milrea?

*Ans.* 4366 milreas, 183 reas.

## V. HOLLAND, FLANDERS, and GERMANY.

They keep their accounts at Antwerp, Amsterdam, Brussels, Rotterdam, and Hamburgh; some in pounds, shillings, and pence, as in England: others in guilders, stivers, and pennings; and exchange with us on our pound at 33*s.* 4*d.* Flemish, at *par.*

NOTE. 8 pennings

make 1 groat.

2 groats, or 16 pennings

— 1 stiver.

20 stivers

— 1 guilder or sterin.

ALSO, 12 groats, or 6 stivers

make 1 schell rg.

20 shillings, or 6 guilders

— 1 pound.

To change Flemish into sterling.

RULE. As the given rate is to one pound, so is the Flemish sum to the sterling required.

To change sterling into Flemish.

RULE. As 1*l.* sterling is to the given rate, so is the sterling given to the Flemish sought.

## EXAMPLES.

(<sup>20</sup>) Remitted from London to Amsterdam a bill of 754*l.* 10*s.* sterling—how many pounds Flemish is the sum, the exchange at 33*s.* 6*d.* Flemish per pound sterling?

*Ans.* £1263 : 15 : 9 Flemish.

(<sup>21</sup>) A merchant at Rotterdam remits 1263*l.* 15*s.* 9*d.* Flemish, to be paid in London—how much sterling money must he draw for, the exchange being at 33*s.* 6*d.* Flemish per pound sterling?

*Ans.* £754 : 10*s.*



(21) If I pay in London 852*l.* 12*s.* 6*d.* sterling—how many guilders must I draw for at Amsterdam, exchange at 34 schellings, 4½ groats Flemish per pound sterling?

*Ans.* 8792 guilders, 13 stivers, 14½ pennings.

(22) What must I draw for at London, if I pay at Amsterdam 8792 guilders, 13 stivers, 14½ pennings, exchange at 34 schellings, 4½ groats per pound sterling?

*Ans.* £852 : 12 : 6*d.*

To convert bank money into current, and the contrary.

NOTE. The bank money is worth more than the current. The difference between the one and the other is called *agio*, and is generally from 3 to 6 per cent. in favour of the bank.

To change bank into current money.

RULE. As 100 guilders bank is to 100 with the agio added, so is the bank given to the current required.

To change current money into bank.

RULE. As 100 with the agio added, is to 100 bank, so is the current money given to the bank required.

(23) Change 794 guilders, 15 stivers, 4 pennings, current money, into bank florins, agio 4⅜ per cent.

*Ans.* 761 guilders, 9 stivers.

(24) Change 761 guilders, 9 stivers, bank, into current money, agio 4⅜ per cent.

*Ans.* 794 guilders, 15 stivers, 4 pennings.

## VI. IRELAND.

(25) A gentleman remits to Ireland 575*l.* 15*s.* sterling—what will he receive there, the exchange being at 10 per cent?

*Ans.* £633 : 6 : 6*d.*

(26) What must be paid in London for a remittance of 633*l.* 6*s.* 6*d.* Irish, exchange being at 10 per cent?

*Ans.* £575 : 15*s.*

## COMPARISON OF WEIGHTS AND MEASURES.

### EXAMPLES.

(1) If 50 Dutch pence be worth 65 French pence—how many Dutch pence are equal to 350 French pence?

*Ans.* 269⅓.

(2) If 12 yards at London make 8 ells at Paris—now many ells at Paris will make 64 yards at London?

*Ans.* 42⅔.

(3) If

(3) If 30 lb. at London make 28 lb. at Amsterdam—how many lb. at London will be equal to 350 lb. at Amsterdam? *Ans.* 375.

(4) If 95 lb. Flemish, make 106 lb. English—how many lb. English are equal to 275 lb. Flemish? *Ans.*  $306\frac{80}{95}$ .

### CONJOINED PROPORTION

**I**S when the coin, weight, or measures of several countries are compared in the same question; or it is linking together a variety of proportions.

When it is required to find how many of the first sort of coin, weight, or measures mentioned in the question, are equal to a given quantity of the last.

**RULE.** Place the numbers alternately, beginning at the left-hand, and let the last number stand on the left-hand; then multiply the first row continually for a dividend; and the second for a divisor.

**PROOF.** By as many Single Rules of Three as the question requires.

#### EXAMPLES.

(1) If 20 lb. at London make 23 lb. at Antwerp, and 155 lb. at Antwerp make 180 lb. at Leghorn—how many lb. at London are equal to 72 lb. at Leghorn?

*Left. Right.*

$$\begin{array}{rcl} 20 & 23 & 20 \times 155 \times 72 = 223200 \\ 155 & 180 & 23 \times 180 = 4140 \end{array} \quad 223200 \div 4140 = 53\frac{1}{4} \times 72$$

(2) If 12 lb. at London make 10 lb. at Amsterdam, and 100 lb. at Amsterdam make 120 lb. at Thoulouse—how many lb. at London are equal to 40 lb. at Thoulouse? *Ans.* 40.

(3) If 140 braces at Venice are equal to 156 braces at Leghorn, and 7 braces at Leghorn equal to 4 ells English—how many braces at Venice are equal to 16 ells English?

*Ans.*  $25\frac{80}{14}$ .

(4) If 40 lb. at London make 36 lb. at Amsterdam, and 90 lb. at Amsterdam make 116 lb. at Dantzick—how many lb. at London are equal to 130 lb. at Dantzick?

*Ans.*  $112\frac{288}{1176}$ .

When it is required to find how many of the last sort of coin, weight, or measure, mentioned in the question, is equal to a quantity of the first.

**RULE.**

**RULE.** Place the numbers alternately, beginning at the left-hand, and let the last number stand on the right hand; then multiply the first row for a divisor, and the second for a dividend.

EXAMPLES.

(5) If 12 lb. at London make 10 lb. at Amsterdam, and 100 lb. at Amsterdam 120 lb. at Thoulouse—how many lb. at Thoulouse are equal to 40 lb. at London? *Ans.* 40 lb.

(6) If 40 lb. at London make 36 lb. at Amsterdam, and 90 lb. at Amsterdam 116 lb. at Dantzick—how many lb. at Dantzick are equal to 122 lb. at London; *Ans.*  $141\frac{1872}{3600}$ .

**PROGRESSION** consists of TWO PARTS:

ARITHMETICAL AND GEOMETRICAL.

ARITHMETICAL PROGRESSION

**I**S when the rank of numbers increase or decrease regularly by the continual adding or subtracting of the equal numbers: As 1, 2, 3, 4, 5, 6, are in Arithmetical Progression by the continual increasing or adding of one; 11, 9, 7, 5, 3, 1, by the continual decreasing or subtracting of two.

**NOTE.** When any even number of terms differ by Arithmetical Progression, the sum of the two extremes will be equal to the two middle numbers, or any two means equally distant from the extremes; as 2, 4, 6, 8, 10, 12, where  $6+8$ , the two middle numbers, are  $= 12+2$ , the two extremes, and  $= 10+4$  the two means,  $= 14$ .

When the number of terms are odd, the double of the middle term will be equal to the two extremes, or of any two means equally distant from the middle term; as 1, 2, 3, 4, 5, where the double of 3  $= 5+1=2+4=6$ .

In Arithmetical Progression five things are to be observed, *viz.*

1. The first term; *better expressed thus,* F.
2. The last term, L.
3. The number of terms, N.
4. The equal difference, D.
5. The sum of all the terms, S.

*Any three of which being given, the other two may be found.*

The first, second, and third terms given, to find the fifth.

RULE. Multiply the sum of the two extremes by half the number of terms, or multiply half the sum of the two extremes by the whole number of terms, the product is the total of all the terms : Or thus,

1. F, L, N, are given to find S.

$$\frac{F+L}{2} \times N = S.$$

#### EXAMPLES.

(1) How many strokes does the hammer of a clock strike in 12 hours. *Ans.* 78.

$$12 + 1 = 13, \text{ then } 13 \times 6 = 78.$$

(2) A man buys 17 yards of cloth, and gave for the first yard 2s. and for the last 10s.—what did the 17 yards amount to ? *Ans.* £5 : 2s.

(3) If 100 eggs were placed in a right line, exactly a yard asunder from one another, and the first a yard from a basket, what length of ground does that man go who gathers up these 100 eggs singly, returning with every egg to the basket to put it in ? *Ans.* 5 miles, 1300 yards.

The first, second, and third terms given to find the fourth,

RULE. From the second subtract the first, the remainder divided by the third less one, gives the fourth : Or thus,

2. F, L, N, are given to find D.

$$\frac{L-F}{N-1} = D.$$

#### EXAMPLES.

(4) A man had 8 sons, the youngest was 4 years old, and the eldest 32, they increase in Arithmetical Progression.—what was the common difference of their ages ? *Ans.* 4.

$$32 - 4 = 28, \text{ then } 28 \div 8 - 1 = 4 \text{ common difference.}$$

(5) A man is to travel from London to a certain place in 12 days, and go about 3 miles the first day, increasing every day by an equal excess, so that the last day's journey may be 58 miles—what is the daily increase, and how many miles distant is that place from London ? *Ans.* 5 daily increase.

Therefore, as 3 miles is to the first day's journey.

$$3 + 5 = 8 \text{ the second day,}$$

$$8 + 5 = 13 \text{ the third day, \&c.}$$

The whole distance is 366 miles, or thus,

$$58 + 3 = 61, \text{ then } 61 \times 6 = 366.$$



The first, second, and fourth terms given to find the third.

RULE. From the second subtract the first, the remainder divide by the fourth, and to the quotient add 1, gives the third: Or thus,

3. F, L, D, are given to find N.

$$\frac{L-F}{D} + 1 = N.$$

EXAMPLES.

(6) A person travelling into the country, went 3 miles the first day, and increased every day by 5 miles, till at last he went 58 miles in one day—how many days did he travel? *Ans.* 12.

$58 - 3 = 55$ , then  $55 \div 5 = 11$  &  $+ 1 = 12$ , the number of days.

(7) A man being asked how many sons he had, said that the youngest was 4 years old, and the eldest 32, and that he increased one in his family every four years—how many had he? *Ans.* 8.

The second, third, and fourth terms given, to find the first.

RULE. Multiply the fourth by the third, made less by 1, the product subtracted from the second gives the first, or thus,

4. L, N, D, are given to find F.

$$\overline{L - D \times N - 1} = F.$$

EXAMPLES.

(8) A man in ten days went from London to a certain town in the country, every day's journey increasing the former by 4, and the last he went was 46 miles—what was the first?

$4 \times 10 - 1 = 36$ , then  $46 - 36 = 10$ , the first day's journey.

(9) A man takes out of his pocket, at eight several times, so many different numbers of shillings, every one exceeding the former by 6, the last 46—what was the first? *Ans.* 4.

The fourth, third, and fifth given, to find the first.

RULE. Divide the fifth by the third, and from the quotient subtract half the product of the fourth multiplied by the third, less 1, gives the first: Or thus,

5. N, D, S, are given to find F.

$$\frac{S}{N} - \frac{D \times N - 1}{2} = F.$$

EXAMPLES.

## EXAMPLES.

(<sup>10</sup>) A man is to receive 360*l.* at 12 several payments, each to exceed the former by 4*l.* and is willing to bestow the first payment on any one who can tell him what it is—what will that person have for his pains? *Ans.* £8.

$360 \div 12 = 30$ , then  $30 - \frac{4 \times 12 - 1}{2} = 8$ , the first payment.

The first, third, and fourth given, to find the second.

RULE. Subtract the fourth from the product of the third, multiplied by the fourth; that remainder, added to the first gives the second: Or thus,

6. F, N, D, are given to find L.

$$ND - D + F = L.$$

## EXAMPLES.

(<sup>11</sup>)—What is the last number of an Arithmetical Progression, beginning at 6, and continuing by the increase of 8 to 20 places? *Ans.* 158.

$20 \times 8 - 8 = 152$ , then  $152 + 6 = 158$ , the last number.

## GEOMETRICAL PROGRESSION

IS the increasing or decreasing of any rank of numbers by some common ratio; that is, by the continual multiplication or division of some equal number; as 2, 4, 8, 16, increase by the multiplier 2, and 16, 8, 4, 2, decrease by the divisor 2.

NOTE. When any number of terms is continued in Geometrical Progression, the product of the two extremes will be equal to any two means equally distant from the extremes; as 2, 4, 8, 16, 32, 64, where  $64 \times 2 = 4 \times 32$ , and  $8 \times 16 = 128$ .

When the number of terms are odd, the middle term multiplied into itself, will be equal to the two extremes, or any two means equally distant from the mean: as 2, 4, 8, 16, 32, where  $2 \times 32 = 4 \times 16 = 8 \times 8 = 64$ .

In Geometrical Progression the same five things are to be observed as in Arithmetical, viz.

1. The

1. The first term.
2. The last term.
3. The number of terms.
4. The equal difference or ratio.
5. The sum of all the terms.

NOTE. As the last term in a long series of numbers is very tedious to come at, by continual multiplication; therefore for the reader finding it out, there is a series of numbers made use of in Arithmetical Proportion, called *indices*, beginning with an unit, whose common difference is one; whatever number of indices you make use of, set as many numbers (in such Geometrical Proportion, as is given in the question under them.

As 1, 2, 3, 4, 5, 6, *indices*.

2, 4, 8, 16, 32, 64, *numbers in Geometrical Proportion*.

But if the first term in Geometrical Proportion be different from the ratio, the indices must begin with a cypher,

As 0, 1, 2, 3, 4, 5, 6, *indices*.

1, 2, 4, 8, 16, 32, 64, *numbers in Geometrical Proportion*.

When the indices begin with a cypher, the sum of the indices made choice of must always be one less than the number of terms given in the question; for 1 in the indices is over the second term, and two over the third, &c.

Add any two of the indices together, and that sum will agree with the product of their respective terms.

As in the first table of indices  $2 + 5 = 7$

Geometrical Proportion  $4 \times 32 = 128$

Then in the second  $\left. \begin{array}{l} 2 + 4 = 6 \\ 4 \times 16 = 64 \end{array} \right\}$

In any Geometrical Progression proceeding from unity, the ratio being known, to find any remote term, without producing all the intermediate terms.

RULE 1. Find what figures of the indices added together, would give the exponent of the term wanted; then multiply the numbers standing under such exponent into each other, and it will give the term required.

When the exponent 1 stands over the second term, the number of exponents must be 1 less than the number of terms.

#### EXAMPLES.

(1) A man agrees for 12 peaches, to pay only the price of the last, reckoning a farthing for the first, and a half-penny

penny for the second, &c. doubling the price to the last—  
what must he give for them?

*Ans.* £2 : 2 : 8.

0, 1, 2, 3, 4, exponents.

1, 2, 4, 8, 16, No. of terms.

$$16=4$$

$$16=4$$

$$256=8$$

$$8=3$$

For  $4+4+3=11$ , No. of terms less 1.

$$4)2048=11 \text{ No. of Far.}$$

$$12)512$$

$$2|0)12:8$$

$$£2:2:8$$

(<sup>1</sup>) A country gentleman going to a fair to buy some oxen, meets with a person who had 23; he demanded the price of them, was answered 16*l.* a-head: the gentleman bids him 15*l.* a-head, and he would buy all: the other tells him it could not be taken: but if he would give what the last ox would come to at a farthing for the first, and doubling it to the last, he should have all—what was the price of the oxen?

*Ans.* £4369 : 1 : 4.

In any Geometrical Progression, not proceeding from unity, the ratio being given, to find any remote term, without producing all the intermediate terms.

RULE 2. Proceed as in the last, only observe that every product must be divided by the first term.

#### EXAMPLES.

(<sup>3</sup>) A sum of money is to be divided amongst 8 persons, the first to have 20*l.* the second 60*l.* and so on in triple proportion—what will the last have?

*Ans.* £43740.

$$0, 1, 2, 3, \frac{540 \times 540}{20} = 14580 \text{ then } \frac{14580 \times 63}{20} = 43740$$

$$3+3+1=7, \text{ one less than the number of terms.}$$

(<sup>4</sup>) A gentleman dying left nine sons, to whom, and to his executors, he bequeathed his estate in manner following: To his executors 50*l.*; his youngest son was to have as much more as the executors, and each son to exceed the next younger by as much more—what was the eldest son's portion?

*Ans.* £25600,  
The



The first term, ratio, and number of terms given to find the number of all the terms.

RULE 3. Find the last term as before, then subtract the first from it, and divide the remainder by the ratio, less one, to the quotient of which add the greater, gives the sum required.

EXAMPLES.

(3) A servant skilled in numbers agreed with a gentleman to serve him twelve months, provided he would give him a farthing for the first month's service, a penny for the second, and 4d. for the third, &c.—what did his wages amount to?

*Ans* £5825 : 8 : 5½.

$256 \times 256 = 65536$ , then  $65536 \times 64 = 4194304$ .

0, 1, 2, 3, 4,  $\frac{4194304 - 1}{4 - 1} = 1398101$ , then

1, 4, 16, 64, 256,  $4 - 1$

$4 + 4 + 3 = 11$ , No. of terms less 1.

$1398101 + 4194304 = 5592405$  farthings.

(6) A man bought a horse, and by agreement was to give a farthing for the first nail, three for the second, &c. there were four shoes, and in each shoe eight nails—what was the worth of the horse?

*Ans* £965-11-4681693 : 13 : 4.

(7) A certain person married his daughter on New-Year's day, and gave her husband 1s. towards her portion, promising to double it on the first day of every month, for one year—what was her portion?

*Ans* £204 : 151.

(8) A laceman, well versed in numbers, agreed with a gentleman to sell him 22 yards of rich gold brocade lace, for 2 pins the first yard, 6 pins the second, &c. in triple proportion—I desire to know what he sold the lace for, if the pins were valued at 100 for a farthing; also what the laceman got or lost by the sale thereof, supposing the lace stood him 7s. per yard?

*Ans*. The lace sold for £326886 : 0 : 9.

Gain £326732 : 0 : 9.

PERMUTATION

IS the changing or varying the order of things.

RULE. Multiply all the given terms one into another, and the last product will be the number of changes required.

EXAMPLES.

(1) How many changes may be rung upon 12 bells; and how long would they be ringing but once over, supposing 10 changes

10 changes might be rung in a minnte, and the year to contain 365 days 6 hours.

$1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8 \times 9 \times 10 \times 11 \times 12 = 479001600$   
*changes, which  $\div 10 = 47900160$  minutes; and if reduced,*  
*is = 91 years, 3 weeks, 5 days, 6 hours.*

(<sup>2</sup>) A young scholar coming into town for the convenience of a good library, demands of a gentleman with whom he lodged, what his diet would cost for a year; who told him 10*l.* but the scholar not being certain what time he would stay, asked him what he must give him for so long as he should place his family, consisting of 6 persons (besides himself) in different positions, every day at dinner. The gentleman thinking it would not be long, tells him 5*l.* to which the scholar agrees—what time did the scholar stay with the gentleman?  
*Ans. 5040 days;*

## PART II.

### VULGAR FRACTIONS.

#### INTRODUCTION.

A FRACTION is a part or parts of the unit, and written with two figures, with a line between them, as  $\frac{1}{2}$ ,  $\frac{5}{6}$ ,  $\frac{3}{8}$ , &c.

The figure above the line is called the *numerator*, and the one under the *denominator*; which shows how many parts the unit is divided into; and the numerator shows how many of those parts are meant by the fraction.

There are four sorts of Vulgar Fractions; *proper*, *improper*, *compound*, and *mixed*; *viz.*

1. A PROPER FRACTION is when the numerator is less than the denominator, as  $\frac{1}{2}$ ,  $\frac{3}{6}$ ,  $\frac{7}{8}$ ,  $\frac{9}{11}$ ,  $\frac{100}{701}$ , &c.

2. AN IMPROPER FRACTION is when the numerator is equal to, or greater than the denominator, as  $\frac{5}{3}$ ,  $\frac{8}{4}$ ,  $\frac{12}{11}$ ,  $\frac{87}{2}$ , &c.

3. A

3. A COMPOUND FRACTION is the fraction of a fraction, and known by the word *of*, as  $\frac{1}{2}$  of  $\frac{2}{3}$  of  $\frac{7}{9}$  of  $\frac{8}{17}$  of  $\frac{9}{12}$ , &c.

4. A MIXED NUMBER OR FRACTION is composed of a whole number or fraction, as  $8\frac{1}{7}$ ,  $17\frac{1}{2}$ ,  $8\frac{1}{9}$ , &c.

## REDUCTION of VULGAR FRACTIONS.

1. *To reduce Fractions to a common Denominator.*

RULE 1. Multiply each numerator into all the denominators, except its own, for a new numerator; and all the denominators for a common denominator. Or,

2. Multiply the common denominator by the several given numerators separately, and divide the product by their several denominators, the quotients will be the new numerators.

### EXAMPLES.

(1) Reduce  $\frac{3}{4}$  and  $\frac{4}{7}$  to a common denominator.

*facit*  $\frac{14}{28}$ , and  $\frac{16}{28}$ .

1<sup>st</sup> num. 2<sup>d</sup> num.

$2 \times 7 = 14$   $4 \times 4 = 16$ , then  $4 \times 7 = 28$  den.  $= \frac{14}{28}$ , and  $\frac{16}{28}$ .

(2) Reduce  $\frac{1}{2}$ ,  $\frac{3}{4}$ , and  $\frac{5}{8}$  to a common denominator.

*facit*  $\frac{32}{64}$ ,  $\frac{48}{64}$ ,  $\frac{40}{64}$ .

(3) Reduce  $\frac{7}{8}$ ,  $\frac{4}{6}$ ,  $\frac{9}{10}$ , and  $\frac{5}{7}$  to a common denominator.

*facit*  $\frac{3240}{3360}$ ,  $\frac{2240}{3360}$ ,  $\frac{3024}{3360}$ ,  $\frac{2880}{3360}$ .

(4) Reduce  $\frac{6}{10}$ ,  $\frac{2}{4}$ ,  $\frac{1}{7}$ , and  $\frac{3}{8}$  to a common denominator.

*facit*  $\frac{1008}{1680}$ ,  $\frac{840}{1680}$ ,  $\frac{240}{1680}$ ,  $\frac{540}{1680}$ .

(5) Reduce  $\frac{4}{5}$ ,  $\frac{2}{3}$ ,  $\frac{3}{7}$ , and  $\frac{1}{8}$  to a common denominator.

*facit*  $\frac{672}{840}$ ,  $\frac{560}{840}$ ,  $\frac{380}{840}$ ,  $\frac{105}{840}$ .

(6) Reduce  $\frac{2}{6}$ ,  $\frac{5}{9}$ ,  $\frac{2}{8}$ , and  $\frac{3}{5}$  to a common denominator.

*facit*  $\frac{720}{2160}$ ,  $\frac{1200}{2160}$ ,  $\frac{540}{2160}$ ,  $\frac{1296}{2160}$ .

2. *To reduce a vulgar fraction to its lowest terms.*

RULE. Find a common measure by dividing the lower term by the upper, and that divisor by the remainder following, till nothing remain; the last divisor is the common measure; then divide both parts of the fraction by the common measure, and the quotient will give the fraction required.

*If the common measure happen to be 1, the fraction is already in its lowest term; and when a fraction hath cyphers at the right hand, it may be abbreviated by cutting them off;*

as,  $\frac{24}{1410}$ .

K

EXAMPLES.

## EXAMPLES.


(7) Reduce  $\frac{24}{32}$  to its lowest terms.

$$\begin{array}{r} 24)32(1 \\ \underline{24} \end{array}$$

com. measure  $8)24(3$ then  $8)\frac{24}{32}(=\frac{3}{4}$  facit.24(8) Reduce  $\frac{30}{84}$  to its lowest terms.facit.  $\frac{5}{14}$ .(9) Reduce  $\frac{208}{64}$  to its lowest terms.facit  $\frac{52}{16}$ .(10) Reduce  $\frac{192}{76}$  to its lowest terms.facit  $\frac{1}{2}$ .(11) Reduce  $\frac{325}{96}$  to its lowest terms.facit  $\frac{5}{16}$ .(12) Reduce  $\frac{3184}{6912}$  to its lowest terms.facit  $\frac{3}{4}$ .

3. To reduce a mixed number to an improper fraction.

RULE. Multiply the whole number by the denominator of the fraction, and to the product add the numerator for a new numerator, which place over the denominator.

 To express a whole number fraction-ways, set one for the denomination given.

## EXAMPLES.

(13) Reduce  $18\frac{3}{7}$  to an improper fraction. facit  $1\frac{29}{7}$ .

$$18 \times 7 + 3 = 129 \text{ new numerator.}$$

(14) Reduce  $56\frac{13}{22}$  to an improper fraction. facit  $1\frac{245}{22}$ .(15) Reduce  $183\frac{5}{21}$  to an improper fraction. facit  $3\frac{843}{21}$ .(16) Reduce  $13\frac{4}{5}$  to an improper fraction. facit  $\frac{69}{5}$ .(17) Reduce  $27\frac{2}{9}$  to an improper fraction. facit  $2\frac{20}{9}$ .(18) Reduce  $514\frac{5}{16}$  to an improper fraction. facit  $8\frac{229}{16}$ .

4. To reduce an improper fraction to its proper terms.

RULE. Divide the upper term by the lower.

## EXAMPLES.

(19) Reduce  $1\frac{29}{7}$  to its proper terms. facit  $18\frac{3}{7}$ .

$$129 \div 7 = 18\frac{3}{7}.$$

(20) Reduce  $1\frac{245}{22}$  to its proper terms. facit  $56\frac{13}{22}$ .(21) Reduce  $3\frac{843}{21}$  to its proper terms. facit  $183\frac{5}{21}$ .(22) Reduce  $\frac{69}{5}$  to its proper terms. facit  $13\frac{4}{5}$ .(23) Reduce  $2\frac{20}{9}$  to its proper terms. facit  $27\frac{2}{9}$ .(24) Reduce  $8\frac{229}{16}$  to its proper terms. facit  $514\frac{5}{16}$ .

5. To



# Reduction of Vulgar Fractions. 111

5. To reduce a compound fraction to a single one.

**RULE.** Multiply all the numerators for a new numerator, and all the denominators for a new denominator. Reduce the new fraction to its lowest terms by **RULE 2**.

## EXAMPLES.

(25) Reduce  $\frac{2}{3}$  of  $\frac{3}{5}$  or  $\frac{5}{8}$  to a single fraction.

*facit*  $2 \times 3 \times 5 = 30$  reduced to the lowest term  $= \frac{1}{4}$ .  
 $3 \times 5 \times 8 = 120$

(26) Reduce  $\frac{5}{9}$  of  $\frac{1}{7}$  of  $\frac{11}{12}$  to a single fraction.

*facit*  $\frac{220}{756} = \frac{55}{189}$ .

(27) Reduce  $\frac{11}{12}$  of  $\frac{13}{14}$  of  $\frac{21}{29}$  to a single fraction.

*facit*  $\frac{3003}{4872} = \frac{143}{232}$ .

(28) Reduce  $\frac{3}{4}$  of  $\frac{5}{6}$  of  $\frac{9}{10}$  to a single fraction.

*facit*  $\frac{135}{240} = \frac{9}{16}$ .

(29) Reduce  $\frac{4}{5}$  of  $\frac{6}{8}$  of  $\frac{7}{9}$  to a single fraction.

*facit*  $\frac{168}{200} = \frac{7}{5}$ .

(30) Reduce  $\frac{2}{7}$  of  $\frac{5}{9}$  of  $\frac{8}{10}$  to a single fraction.

*facit*  $\frac{80}{630} = \frac{8}{63}$ .

6. To reduce fractions of one denomination to the fraction of another, but greater, retaining the same value.

**RULE.** Reduce the given fraction to a compound one, by comparing it with all the denominations between it, and that denomination which you would reduce it to; then reduce that compound fraction to a single one.

## EXAMPLES.

(31) Reduce  $\frac{7}{8}$  of a penny to the fraction of a pound.

*facit*  $\frac{7}{8}$  of  $\frac{1}{12}$  of  $\frac{1}{20} = \frac{7}{1920}$ .

(32) Reduce  $\frac{1}{4}$  of a penny to the fraction of a pound.

*facit*  $\frac{1}{960}$ .

(33) Reduce  $\frac{4}{5}$  of a cwt. to the fraction of a lb. Troy.

*facit*  $\frac{4}{1200}$ .

(34) Reduce  $\frac{4}{7}$  of a lb. Avoirdupoise to the fraction of a cwt.

*facit*  $\frac{4}{7 \times 4}$ .

7. To reduce fractions of one denomination to the fraction of another, but less, retaining the same value.

**RULE.** Multiply the numerator by the parts contained in the several denominations between it, and that you would reduce it to, for a new numerator, and place it over the denominator.

Reduce the new fraction to its lowest terms.

# 112 *Reduction of Vulgar Fractions.*

## EXAMPLES.

(<sup>35</sup>) Reduce  $\frac{7}{1920}$  of a pound to the fraction of a penny.  
*facit*  $\frac{7}{8}$ .

$7 \times 20 \times 12 = 1680$   $\frac{1680}{1920}$  reduced to its lowest term  $= \frac{7}{8}$ .

(<sup>36</sup>) Reduce  $\frac{1}{560}$  of a pound to the fraction of a penny.  
*facit*  $\frac{1}{4}$ .

(<sup>37</sup>) Reduce  $\frac{4}{1200}$  of a lb. Troy to the fraction of a penny-weight.  
*facit*  $\frac{1}{3}$ .

(<sup>38</sup>) Reduce  $\frac{4}{784}$  of a cwt. to the fraction of a lb.  
*facit*  $\frac{1}{7}$ .

8. To reduce fractions of one denomination to another of the same value, having the numerator given of the required fraction.

RULE. As the numerator of the given fraction is to its denominator, so is the numerator of the intended fraction to its denominator.

## EXAMPLES.

(<sup>39</sup>) Reduce  $\frac{2}{3}$  to a fraction of the same value, whose numerator shall be 12. As  $2 : 3 :: 12 : 18$ . *facit*  $\frac{12}{18}$

(<sup>40</sup>) Reduce  $\frac{5}{7}$  to a fraction of the same value, whose numerator shall be 25. *facit*  $\frac{25}{7}$ .

(<sup>41</sup>) Reduce  $\frac{5}{7}$  to a fraction of the same value, whose numerator shall be 47.

*facit.*  $\frac{47}{65\frac{2}{3}}$

9. To reduce fractions of one denomination to another of the same value, having the denominator given of the fraction required.

RULE. As the denominator of the given fraction is to its numerator, so is the denominator of the intended fraction to its numerator.

## EXAMPLES.

(<sup>42</sup>) Reduce  $\frac{2}{3}$  to a fraction of the same value, whose denominator shall be 18. As  $3 : 2 :: 18 : 12$ . *facit*  $\frac{12}{18}$ .

(<sup>43</sup>) Reduce  $\frac{5}{7}$  to a fraction of the same value, whose denominator shall be 35. *facit*  $\frac{25}{35}$ .

(<sup>44</sup>) Reduce  $\frac{5}{7}$  to a fraction of the same value, whose denominator shall be  $65\frac{2}{3}$ .

*facit*  $\frac{47}{65\frac{2}{3}}$   
 10. 70

10. To reduce a mixed fraction to a single one.

RULE. When the numerator is the integral part, multiply it by the denominator of the fractional part, adding in the numerator of the fractional part for a new numerator; then multiply the denominator of the fraction by the denominator of the fractional part for a new denominator.

EXAMPLES.

(45) Reduce  $36\frac{2}{48}$  to a simple fraction. *facit*  $\frac{110}{144} = \frac{55}{72}$ .

$$36 \times 3 + 2 = 110 \text{ numerator.}$$

$$48 \times 3 = 144 \text{ denominator.}$$

(46) Reduce  $23\frac{5}{38}$  to a simple fraction. *facit*  $\frac{883}{1404} = \frac{83}{133}$ .

When the denominator is the integral part, multiply it by the denominator of the fractional part, adding in the numerator of the fractional part for a new denominator: then multiply the numerator of the fraction by the denominator of the fractional part for a new numerator.

EXAMPLES.

(47) Reduce  $47\frac{4}{65}$  to a simple fraction. *facit*  $\frac{3054}{1325} = \frac{57}{25}$ .

(48) Reduce  $19\frac{1}{44}$  to a simple fraction. *facit*  $\frac{837}{452} = \frac{37}{20}$ .

11. To find the proper quantity of a fraction in the known parts of an integer.

RULE. Multiply the numerator by the common parts of the integer, and divide by the denominator.

EXAMPLES.

(49) Reduce  $\frac{3}{4}$  of a pound sterling to its proper quantity.  $3 \times 20 = 60$ , and  $\div 4 = 15s$ . *facit* 15s.

(50) Reduce  $\frac{2}{3}$  of a shilling to its proper quantity. *facit* 4d.  $3\frac{1}{3}$  qrs.

(51) Reduce  $\frac{4}{7}$  of a lb. Avoirdupoise to its proper quantity. *facit* 9 oz.  $2\frac{2}{7}$  dr.

(52) Reduce  $\frac{7}{9}$  of a cwt. to its proper quantity. *facit* 3 qrs. 3 lb. 1 oz.  $12\frac{4}{9}$  dr

(53) Reduce  $\frac{3}{5}$  of a lb. Troy to its proper quantity. *facit* 7 oz. 4 dwt.

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- (<sup>54</sup>) Reduce  $\frac{5}{9}$  of an ell English to its proper quantity.  
*facit 2 qrs.  $3\frac{1}{2}$  nails.*
- (<sup>55</sup>) Reduce  $\frac{4}{5}$  of a mile to its proper quantity.  
*facit 6 furl. 16 poles.*
- (<sup>56</sup>) Reduce  $\frac{5}{8}$  of an acre to its proper quantity.  
*facit 2 roods 20 poles.*
- (<sup>57</sup>) Reduce  $\frac{6}{7}$  of a hoghead of wine to its proper quantity.  
*facit 54 gallons.*
- (<sup>58</sup>) Reduce  $\frac{3}{5}$  of a barrel of beer to its proper quantity.  
*facit 12 gallons.*
- (<sup>59</sup>) Reduce  $\frac{5}{12}$  of a chaldron of coals to its proper quantity.  
*facit 15 bushels.*
- (<sup>60</sup>) Reduce  $\frac{3}{5}$  of a month to its proper time.  
*facit 2 weeks, 2 days,  $19\frac{1}{3}$  hours.*

12. *To reduce any given quantity to the fraction of any greater denomination, retaining the same value.*

**RULE.** Reduce the given quantity to the lowest term mentioned for a numerator, under which set the integral part (reduced to the same term) for a denominator, and it will give the fraction required.

## EXAMPLES.

- (<sup>61</sup>) Reduce 15s. to the fraction of a pound sterling.  
*facit  $\frac{15}{20} = \frac{3}{4}$ l.*
- (<sup>62</sup>) Reduce 4d.  $3\frac{1}{2}$  qrs. to the fraction of a shilling.  
*facit  $\frac{2}{3}$ .*
- (<sup>63</sup>) Reduce 9 oz.  $2\frac{2}{7}$  dr. to the fraction of a lb. Avoirdupoise.  
*facit  $\frac{4}{7}$ .*
- (<sup>65</sup>) Reduce 3 qrs. 3 lb. 1 oz.  $12\frac{4}{9}$  dr. to the fraction of a cwt.  
*facit  $\frac{7}{9}$ .*
- (<sup>64</sup>) Reduce 7 oz. 4 dwt. to the fraction of a lb. Troy.  
*facit  $\frac{3}{4}$ .*
- (<sup>66</sup>) Reduce 2 qrs.  $3\frac{1}{2}$  nails to the fraction of an English ell.  
*facit  $\frac{5}{9}$ .*
- (<sup>67</sup>) Reduce 6 furlongs 16 poles to the fraction of a mile.  
*facit  $\frac{4}{5}$ .*
- (<sup>68</sup>) Reduce 2 roods 20 poles to the fraction of an acre.  
*facit  $\frac{5}{8}$ .*
- (<sup>69</sup>) Reduce 54 gallons to the fraction of a hoghead of wine.  
*facit  $\frac{6}{7}$ .*
- (<sup>70</sup>) Reduce 12 gallons to the fraction of a barrel of beer.  
*facit  $\frac{1}{3}$ .*



(7<sup>1</sup>) Reduce 15 bushels to the fraction of a chaldron of coals. *facit*  $\frac{5}{12}$ .

(7<sup>2</sup>) Reduce 2 weeks, 2 days, 19 $\frac{1}{2}$  hours, to the fraction of a month. *facit*  $\frac{3}{5}$ .

## ADDITION OF VULGAR FRACTIONS.

### RULE.

**R**EDUCE the given fractions to a common denominator, then add all the numerators together, under which place the common denominator.

### EXAMPLES.

(1) Add  $\frac{2}{3}$  and  $\frac{5}{7}$  together. *facit*  $\frac{14}{21} + \frac{15}{21} = \frac{29}{21} = 1\frac{8}{21}$ .

(2) Add  $\frac{3}{4}$ ,  $\frac{2}{7}$ , and  $\frac{5}{8}$  together. *facit*  $1\frac{14}{56} + \frac{16}{56} + \frac{15}{56} = 1\frac{45}{56}$ .

(3) Add  $\frac{1}{5}$ ,  $4\frac{1}{3}$ , and  $\frac{2}{3}$  together. *facit*  $4\frac{7}{15}$ .

(4) Add  $7\frac{2}{3}$  and  $\frac{2}{5}$  together. *facit*  $8\frac{11}{15}$ .

(5) Add  $\frac{2}{7}$  and  $\frac{2}{3}$  of  $\frac{3}{4}$  together. *facit*  $\frac{11}{14}$ .

(6) Add  $5\frac{2}{3}$ ,  $6\frac{7}{8}$ , and  $4\frac{1}{2}$  together. *facit*  $17\frac{1}{24}$ .

When the fractions are of several denominations, reduce them to their proper quantities, and add as before.

(7) Add  $\frac{3}{4}$  of a pound to  $\frac{5}{8}$  of a shilling. *facit* 15s. 10d.

(8) Add  $\frac{1}{2}$  of a penny to  $\frac{2}{3}$  of a pound. *facit* 13s. 4 $\frac{1}{2}$ d.

(9) Add  $\frac{3}{4}$  of a pound Troy to  $\frac{1}{6}$  of an ounce. *facit* 9 oz. 3 dwt. 8 gr.

(10) Add  $\frac{4}{5}$  of a ton to  $\frac{5}{6}$  of a lb. *facit* 16 cwt. 13 oz. 5 $\frac{1}{3}$  dr.

(11) Add  $\frac{2}{3}$  of a chaldron to  $\frac{3}{4}$  of a bushel. *facit* 24 bush. 3 pecks.

(12) Add  $\frac{1}{6}$  of a yard to  $\frac{2}{3}$  of an inch. *facit* 6 inch. 2 bar. c.

## SUBTRACTION OF VULGAR FRACTIONS.

### RULE.

**R**EDUCE the given fractions to a common denominator, then subtract the less numerator from the greater, and place the remainder over the common denominator.

2. When the lower fraction is greater than the upper, subtract the numerator of the lower fractions from the denominator, and to that difference add the upper numerator, carrying one to the unit's place of the lower whole number.

### EXAMPLES.

# 116 Multiplication of Vulgar Fractions.

## EXAMPLES.


- (<sup>1</sup>) From  $\frac{3}{4}$  take  $\frac{5}{7}$ .  
 $3 \times 7 = 21, 5 \times 4 = 20, 21 - 20 = 1 \text{ num. } 4 \times 7 = 28 \text{ den.} = \frac{1}{28}$ .  
 (<sup>2</sup>) From  $\frac{5}{6}$  take  $\frac{3}{5}$  of  $\frac{5}{8}$ . *facit*  $\frac{11}{40}$ .  
 (<sup>3</sup>) From  $5\frac{2}{3}$  take  $\frac{8}{10}$ . *facit*  $4\frac{23}{30}$ .  
 (<sup>4</sup>) From  $\frac{38}{47}$  take  $\frac{3}{5}$ . *facit*  $\frac{49}{235}$ .  
 (<sup>5</sup>) From  $\frac{19}{20}$  take  $\frac{1}{7}$  of  $\frac{2}{3}$ . *facit*  $\frac{359}{420}$ .  
 (<sup>6</sup>) From  $64\frac{1}{4}$  take  $\frac{2}{3}$  of  $\frac{3}{4}$ . *facit*  $63\frac{3}{4}$ .  
 When the fractions are of several denominations, reduce them to their proper quantities, and subtract as before.

- (<sup>7</sup>) From  $\frac{3}{4}$  of a pound take  $\frac{3}{4}$  of a shilling, *facit* 14s. 3d.  
 (<sup>8</sup>) From  $\frac{2}{3}$  of a shilling take  $\frac{1}{2}$  of a penny. *facit* 7½d.  
 (<sup>9</sup>) From  $\frac{3}{4}$  of a lb. Troy take  $\frac{1}{6}$  of an ounce.  
*facit* 8 oz. 16 dwt. 16 grs.  
 (<sup>10</sup>) From  $\frac{4}{5}$  of a ton take  $\frac{5}{6}$  of a lb.  
*facit* 15 cwt. 3 qrs. 27 lb. 2 oz. 10½ dr.  
 (<sup>11</sup>) From  $\frac{2}{3}$  of a chaldron take  $\frac{3}{4}$  of a bushel.  
*facit* 23 bush. 1 peck.  
 (<sup>12</sup>) From  $\frac{1}{6}$  of a yard take  $\frac{2}{3}$  of an inch, *facit* 5 in. 1 b. c.

## MULTIPLICATION of VULGAR FRACTIONS.

### RULE.

**P**REPARE the given numbers (if they require it) by the rules of Reduction; then multiply the numerators together for a new numerator, and the denominators for a new denominator.

 When any number, either whole or mixed, is multiplied by a fraction, the product will be always less than the multiplicand, in the same proportion as the multiplying fraction is less than the unit.

## EXAMPLES.

- (<sup>1</sup>) Multiply  $\frac{3}{4}$  by  $\frac{2}{5}$ , *facit*  $3 \times 2 = 6 \text{ num. } 4 \times 5 = 20 \text{ den.} = \frac{6}{20}$ .  
 (<sup>2</sup>) Multiply  $\frac{7}{9}$  by  $\frac{2}{3}$ . *facit*  $\frac{14}{27}$ .  
 (<sup>3</sup>) Multiply  $48\frac{3}{5}$  by  $13\frac{5}{6}$ . *facit*  $672\frac{9}{30}$ .  
 (<sup>4</sup>) Multiply  $430\frac{6}{10}$  by  $18\frac{3}{7}$ . *facit*  $7935\frac{24}{70}$ .  
 (<sup>5</sup>) Multiply  $\frac{16}{21}$  by  $\frac{3}{4}$  of  $\frac{5}{7}$  of  $\frac{4}{5}$ . *facit*  $\frac{96}{294} = \frac{16}{49}$ .  
 (<sup>6</sup>) Multiply  $\frac{9}{10}$  by  $\frac{2}{3}$  of  $\frac{3}{4}$  of  $\frac{5}{6}$ . *facit*  $\frac{3}{8}$ .  
 (<sup>7</sup>) Multiply  $\frac{3}{4}$  of  $\frac{2}{3}$  by  $\frac{2}{3}$  of  $\frac{1}{3}$ . *facit*  $\frac{1}{9}$ .  
 (<sup>8</sup>) Multiply  $\frac{1}{4}$  of  $\frac{3}{5}$  by  $\frac{5}{7}$ . *facit*  $\frac{15}{224}$ .  
 (<sup>9</sup>) Multiply  $5\frac{6}{7}$  by  $\frac{5}{6}$ . *facit*  $\frac{37}{2}$ .  
 (<sup>10</sup>) Mul-

- (<sup>10</sup>) Multiply 24 by  $\frac{2}{3}$ . *facit* 16.  
 (<sup>11</sup>) Multiply  $\frac{3}{4}$  of 9 by  $\frac{7}{8}$ . *facit*  $5\frac{29}{8}$ .  
 (<sup>12</sup>) Multiply  $9\frac{1}{2}$  by  $\frac{2}{6}$ . *facit*  $3\frac{1}{3}$ .

## DIVISION OF VULGAR FRACTIONS.

### RULE.

**P**REPARE the given numbers (if they require it) by the rules of Reduction, then multiply the denominator of the divisor into the numerator of the dividend for a new numerator, and the numerator of the divisor into the denominator of the dividend for a new denominator.

*When any whole number is divided by a fraction less than unity, the quotient will be greater than the dividend: but if any fraction be divided by a whole number greater than unity, the quotient will be less than the dividend.*

### EXAMPLES.

- (<sup>1</sup>) Divide  $\frac{9}{20}$  by  $\frac{3}{5}$ .  $5 \times 9 = 45$  num.  $3 \times 20 = 60$  den.  $\frac{45}{60} = \frac{3}{4}$ .  
 (<sup>2</sup>) Divide  $\frac{1}{2}$  by  $\frac{2}{3}$ . *facit*  $\frac{3}{4}$ .  
 (<sup>3</sup>) Divide  $672\frac{9}{10}$  by  $13\frac{5}{8}$ . *facit*  $48\frac{3}{4}$ .  
 (<sup>4</sup>) Divide  $7935\frac{2}{3}$  by  $18\frac{3}{7}$ . *facit*  $430\frac{3}{5}$ .  
 (<sup>5</sup>) Divide  $\frac{3}{8}$  by  $\frac{2}{3}$  of  $\frac{3}{4}$  of  $\frac{5}{8}$ . *facit*  $\frac{9}{16}$ .  
 (<sup>6</sup>) Divide  $\frac{2}{3}$  of 16 by  $\frac{5}{6}$  of  $\frac{3}{4}$ . *facit*  $19\frac{1}{4}$ .  
 (<sup>7</sup>) Divide  $\frac{1}{2}$  of  $\frac{2}{3}$  by  $\frac{2}{3}$  of  $\frac{3}{4}$ . *facit*  $\frac{2}{3}$ .  
 (<sup>8</sup>) Divide  $9\frac{2}{12}$  by  $\frac{1}{2}$  of 7. *facit*  $2\frac{1}{2}$ .  
 (<sup>9</sup>) Divide  $\frac{9}{16}$  by  $4\frac{1}{2}$ . *facit*  $\frac{3}{8}$ .  
 (<sup>10</sup>) Divide 16 by 24. *facit*  $\frac{2}{3}$ .  
 (<sup>11</sup>) Divide  $5205\frac{1}{10}$  by  $\frac{4}{5}$  of 91. *facit*  $71\frac{1}{2}$ .  
 (<sup>12</sup>) Divide  $3\frac{1}{2}$  by  $9\frac{1}{2}$ . *facit*  $\frac{1}{3}$ .

## THE SINGLE RULE OF THREE DIRECT IN VULGAR FRACTIONS.

### RULE.

**R**EDUCE the numbers as before directed in Reduction, so that the first and third may be of the same name: multiply the numerator of the first fraction by the denominator of the second and third, for a new denominator; then multiply the denominator of the first fraction by the numerator of the second and third, for a new numerator; that fraction will be the answer to the question, which reduce to its

# 118 The Single Rule of Three, &c.

its proper quantity.—Or, when the three terms are properly reduced, proceed as in the Rule of Three of whole numbers.

## EXAMPLES.

(<sup>1</sup>) If  $\frac{3}{4}$  of a yard cost  $\frac{5}{8}$  of a £—what will  $\frac{9}{10}$  of a yard come to at that rate? *Ans.*  $\frac{18}{24} = 15s.$

$$\frac{3}{4} yd. : \frac{5}{8} l. :: \frac{9}{10} yd. : \frac{18}{24} l.$$

$$\text{for } 4 \times 5 \times 9 = 180 \text{ num. or } \frac{5}{8} \times \frac{9}{10} = \frac{45}{80} \quad \frac{3}{4} \frac{45}{80} (\frac{15}{16}).$$

$$\text{and } 3 \times 8 \times 10 = 240 \text{ den.}$$

(<sup>2</sup>) If  $\frac{5}{6}$  of a yard cost  $\frac{2}{3}$  of a £.—what will  $\frac{11}{12}$  of a yard cost? *Ans.* 14s. 8d.

(<sup>3</sup>) If  $\frac{3}{4}$  of a yard of lawn cost 7s. 3d.—what will  $10\frac{1}{2}$  yards cost? *Ans.* £4 : 19 : 10 $\frac{1}{2}$  :  $\frac{2}{3}$ .

(<sup>4</sup>) If  $\frac{7}{8} lb.$  cost  $\frac{3}{4}s.$ —how many pounds will  $\frac{8}{9}$  of 1s. buy. *Ans.*  $1\frac{1}{2} lb.?$

(<sup>5</sup>) If  $\frac{3}{5}$  ell of Holland cost  $\frac{1}{3} l.$ —what will  $12\frac{2}{3}$  ells cost at that rate? *Ans.* £7 : 0 : 8 $\frac{3}{4}$   $\frac{5}{9}$ .

(<sup>6</sup>) If  $12\frac{1}{2}$  yards of cloth cost 15s. 9d.—what will 48 $\frac{1}{4}$  yards cost at the same rate? *Ans.* £3 : 0 : 9 $\frac{1}{2}$   $\frac{4}{1}$ .

(<sup>7</sup>) If  $\frac{9}{10}$  of a cwt. cost 284s.—what will  $7\frac{1}{2}$  cwt. cost at the same rate? *Ans.* £118 : 6 : 8.

(<sup>8</sup>) If three yards of broad cloth cost  $2\frac{4}{5} l.$ —what will  $10\frac{2}{7}$  yards cost? *Ans.* £9 : 12s.

(<sup>9</sup>) If  $\frac{1}{4}$  of a yard cost  $\frac{2}{3}$  of a £.—what will  $\frac{3}{5}$  of an ell English come to at the same rate? *Ans.* £2.

(<sup>10</sup>) If 1 lb. of cochineal cost 1l. 5s.—what will 36 $\frac{7}{10}$  lb. come to? *Ans.* £45 : 17 : 6.

(<sup>11</sup>) If 1 yard of broad cloth cost  $15\frac{5}{8}s.$ —what will 4 pieces cost, each containing  $27\frac{3}{7}$  yards? *Ans.* £85 : 14 : 3 $\frac{1}{4}$   $\frac{7}{1}$ .

(<sup>12</sup>) Bought  $3\frac{1}{2}$  pieces of silk, each containing  $24\frac{3}{8}$  ells, at 6s. 0 $\frac{1}{4}$ d. per ell—I desire to know what the whole quantity cost? *Ans.* £25 : 17 : 2 $\frac{1}{4}$   $\frac{15}{8}$ .

## THE SINGLE RULE OF THREE INVERSE IN VULGAR FRACTIONS.

### EXAMPLES.

(<sup>1</sup>) IF 48 men can build a wall in  $24\frac{1}{4}$  days—how many men can do the same in 19 $\frac{1}{2}$  days? *Ans.*  $6\frac{48}{768} men.$

(<sup>2</sup>) If  $25\frac{7}{8}s.$  will pay for the carriage of a cwt. 145 $\frac{1}{4}$  miles—how far may  $6\frac{1}{2}$  cwt. be carried for the same money? *Ans.*  $22\frac{9}{20} miles.$

3. If



(3) If  $3\frac{1}{4}$  yards of cloth, that is  $1\frac{1}{2}$  yard wide, be sufficient to make a cloak—how much must I have of that sort which is  $\frac{4}{5}$  yard wide, to make another of the same bigness?

*Ans.*  $4\frac{7}{8}$  yards

(4) If 3 men can do a piece of work in  $4\frac{1}{2}$  hours—in how many hours will 10 men do the same work?

*Ans.*  $1\frac{7}{8}$  hour.

(5) If a penny white loaf weigh 7 oz. when a bushel of wheat cost  $5s. 6d.$ —what is the bushel worth when the penny-white loaf weighs but  $2\frac{1}{2}$  oz.?

*Ans.*  $15s. 4\frac{4}{5}d.$

(6) What quantity of shalloon that is  $\frac{3}{4}$  yard wide will line  $7\frac{1}{2}$  yards of cloth that is  $1\frac{1}{2}$  yard wide?

*Ans.*  $15$  yards.

### THE DOUBLE RULE OF THREE IN VULGAR FRACTIONS.

#### EXAMPLES.

(1) IF a carrier receive  $2\frac{1}{10}l.$  for the carriage of 3 cwt. 150 miles—how much ought he to receive for the carriage of 7 cwt.  $3\frac{1}{2}$  qrs. 50 miles?

*Ans.*  $£1 : 16 : 9.$

(2) If 100*l.* in 12 months gain 6*l.* interest—what principal will gain  $3\frac{3}{8}l.$  in 9 months?

*Ans.* 75*l.*

(3) If 9 students spend 10*l.* in 18 days—how much will 20 students spend in 30 days?

*Ans.*  $£39 : 18 : 4\frac{360}{1338}.$

(4) A man and his wife having laboured one day, earned  $4\frac{5}{8}s.$ —how much must they have for  $10\frac{1}{2}$  days, when their two sons helped them?

*Ans.*  $£4 : 17 : 1\frac{1}{2}.$

(5) If 50*l.* in 5 months, gain  $2\frac{37}{44}l.$ —what time will 13*l.* require to gain  $1\frac{1}{5}l.$

*Ans.* 9 months.

(6) If the carriage of 60 cwt. 20 miles cost  $14\frac{1}{2}l.$ —what weight can I have carried 30 miles for  $5\frac{7}{8}l.$ ?

*Ans.* 15 cwt.

## PART III.

## DECIMAL FRACTIONS.

## NUMERATION.

IN decimal fractions the integer, or whole thing, as one pound, one yard, one gallon, &c. is supposed to be divided into ten equal parts, and those parts into tenths, and so on, without end.

So that the denominator of a decimal being always known to consist of an unit, with as many cyphers as the numerator has places, is therefore never set down; the parts being only distinguished from the whole numbers, by a comma prefixed; thus, ,5 which stands for  $\frac{5}{10}$ , ,25 for  $\frac{25}{100}$ , ,123 for  $\frac{123}{1000}$ .

But the different value of figures appears plainer by the following table.

Whole numbers.										Decimal parts.						
7	6	5	4	3	2	1	2	3	4	5	6	7				
Millions.							Parts of Millions.									
C of Thousands.							Parts of C Thousands.									
X of Thousands.							Parts of X Thousands.									
Thousands.							Parts of Thousands.									
Hundreds.							Parts of Hundreds.									
Tens.							Parts of Tens.									
Units.																

From which it plainly appears, that as whole numbers increase in a tenfold proportion to the left-hand, decimal parts decrease in a tenfold proportion to the right-hand: so that cyphers placed before decimal parts decrease their value, by removing them farther from the comma, or unit's place, thus, ,5 is 5 parts of 10, or  $\frac{5}{10}$ , ,05 is 5 parts of 100, or  $\frac{5}{100}$ ; ,005, is 5 parts of 1000, or  $\frac{5}{1000}$ ; ,0005, is 5 parts of 10000, or  $\frac{5}{10000}$ . But cyphers after decimal parts do not alter their value. For ,5, ,50, ,500, &c. are each but  $\frac{5}{10}$  of the unit,

A **FINITE DECIMAL** is that which ends at a certain number of places; but an **INFINITE** is that which no where ends.

A **RECURRING DECIMAL** is that wherein one or more figures are continually repeated, as 2,75232.

And 52,275275275 is called a **COMPOUND RECURRING DECIMAL**.

**NOTE.** *A finite decimal may be considered as infinite by making cyphers to recur; for they do not alter the value of the decimal.*

*In all operations, if the result consists of several nines, reject them, and make the next superior place an unit more; thus, for 26,25999 write 26,26.*

*In all circulating numbers, dash the last figure; thus as in 86,54566.*

## ADDITION OF DECIMALS.

### RULE.

**I**N setting down the proposed numbers to be added, great care must be taken in placing every figure directly underneath those of the same value, whether they be mixed numbers, or pure decimal parts: and to perform which there must be a due regard had to the commas, or separating points, which ought always to stand in a direct line, one under another, and to the right hand of them carefully place the decimal parts, according to their respective values; then add them as in whole numbers.

### EXAMPLES.

(<sup>1</sup>) Add 72,5 + 32,07 + 2,1574 + 371,4 + 2,75 + 480,8784.

(<sup>2</sup>) Add 30,07 + 2,0071 + 59,4 + 3207,1.

(<sup>3</sup>) Add 3,5 + 47,25 + 927,01 + 2,0073 + 1,5.

(<sup>4</sup>) Add 52,75 + 47,21 + 724 + 31,452 + 3075.

(<sup>5</sup>) Add 3275 + 27,514 + 1,005 + 725 + 7,32.

(<sup>6</sup>) Add 27,5 + 52 + 3,2075 + 5741 + 2720.

## SUBTRACTION OF DECIMALS.

### RULE.

**S**UBTRACTION, of Decimals differs but little from whole numbers, only in placing the numbers, which must be carefully observed, as in Addition.

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EXAMPLES.

- |  |   |
|--|---|
| ( <sup>1</sup> ) From ,2754 take ,2371   | ( <sup>5</sup> ) From 571 take 54,72    |
| ( <sup>2</sup> ) From 2,37 take 1,76     | ( <sup>6</sup> ) From 625 take 76,91    |
| ( <sup>3</sup> ) From 271 take 215,7     | ( <sup>7</sup> ) From 23,415 take ,3742 |
| ( <sup>4</sup> ) From 270,2 take 76,4075 | ( <sup>8</sup> ) From ,107 take ,0007   |

## MULTIPLICATION OF DECIMALS.

## RULE.

**P**LACE the factors, and multiply them as in whole numbers, and from the product towards the right hand cut off as many places for decimals as there are in both factors together; but if there should not be so many places in the product, supply the defect with cyphers to the left-hand.

## EXAMPLES.

- |   |   |
|---|---|
| ( <sup>1</sup> ) Multiply ,2365 by ,2435. <i>facit</i> ,05758775. | ( <sup>7</sup> ) Mult. 27,35 by 7,70071 |
| ( <sup>2</sup> ) Mult. 2,071 by 2,27                              | ( <sup>8</sup> ) Mult. 5,721 by ,0075   |
| ( <sup>3</sup> ) Mult. 27,15 by 25,3                              | ( <sup>9</sup> ) Mult. 2,07 by ,007     |
| ( <sup>4</sup> ) Mult. 79347 by 23,15                             | ( <sup>10</sup> ) Mult. 20,15 by ,2705  |
| ( <sup>5</sup> ) Mult. 17105 by ,3257                             | ( <sup>11</sup> ) Mult. ,907 by ,0025   |
| ( <sup>6</sup> ) Mult. 17105 by ,0237                             |   |

When any number of decimals is to be multiplied by 10, 100, 1000, &c. it is only removing the separating point in the multiplicand so many places towards the right-hand as there are cyphers in the multiplier: thus,  $578 \times 10 = 5,78$ ,  $578 \times 100 = 57,8$ ,  $578 \times 1000 = 578$ ,  $578 \times 10000 = 5780$ .

## Contracted MULTIPLICATION of DECIMALS.

## RULE.

**P**UT the unit's place of the multiplier under that place of the multiplicand, that is intended to be kept in the product; then invert the order of all the other figures, *i. e.* write them all the contrary way; then in multiplying, begin at the figure in the multiplicand, which stands over the figure you are then multiplying with, and set down the first figure of each particular product directly one under the other, and have a due regard to the increase arising from the figures on the right-hand of that figure you begin to multiply at in the multiplicand.

*That*



That in multiplying the figure left out every time next the right-hand in the multiplicand, if the product be 5, or upwards to 15, carry 1; if 15, or upwards to 25, carry 2; and if 25, or upwards to 35, carry 3, &c.

EXAMPLES.

(<sup>12</sup>) Multiply 384,672158 by 36,8345, and let there be only four places of decimals in the product?

*Contracted Way.*

384,672158  
5438,63

115401647

23080329

3077377

115402

15387

1923

14169,2065

*facit* 14169,2065.

*Common Way.*

384,672158  
36,8345

1923|360790

15380|88632

115401|6474

3077377|264

23080329|48

115401647|4

14169,2066|038510

(<sup>13</sup>) Multiply 3,141592 by 52,7438, and leave only 4 places of decimals. *facit* 165,6994.

(<sup>14</sup>) Multiply 2,38645 by 8,2175, and leave only 4 places of decimals. *facit* 19,6107.

(<sup>15</sup>) Multiply 375,13758 by 16,7324, and let there be only 1 place of decimals. *facit* 6276,9

(<sup>16</sup>) Multiply 375,13758 by 16,7324, and leave only 4 places of decimals. *facit* 6276,9520.

(<sup>17</sup>) Multiply 395,3756 by ,75642, and let there be only 4 places of Decimals.

DIVISION OF DECIMALS.

THIS rule is also worked as in whole numbers: The only difficulty is in valuing the quotient, which is done by any of the following rules.

RULE 1. The first figure in the quotient is always of the same value with that figure of the dividend, which answers or stands over the place of units in the divisor.

L 2

2. The

## 124 *Contracted Division of Decimals.*

2. The quotient must always have so many decimal places as the dividend has more than the divisor.

NOTE 1. *If the divisor and dividend have both the same number of decimal parts, the quotient will be a whole number.*

2. *If the dividend hath not so many places of decimals as are in the divisor, then so many cyphers must be annexed to the dividend as will make them equal, and the quotient will then be a whole number.*

3. *But if, when the division is done, the quotient has not so many figures, as it should have places of decimals, then so many cyphers must be prefixed as there are places wanting.*

### EXAMPLES.

(<sup>1</sup>) Divide 8564.825 by 6,321. *facit* 1354.9.

(<sup>2</sup>) Divide 48 by .144 | (<sup>7</sup>) Divide 7382.54 by 6.4252

(<sup>3</sup>) Divide 217.75 by 65. | (<sup>8</sup>) Divide .0851648 by 4323

(<sup>4</sup>) Divide 125 by .1045. | (<sup>9</sup>) Divide 267.15975 by 1.25

(<sup>5</sup>) Divide 709. by 2.574. | (<sup>10</sup>) Divide 72.1564 by .1347

(<sup>6</sup>) Divide 5.714 by 8275. | (<sup>11</sup>) Divide 715 by .3075.

When numbers are to be divided by 10, 100, 1000, 10000, &c. it is performed by placing the separating point in the dividend, so many places towards the left-hand, as there are cyphers in the divisor.

Thus,  $5784 \div 10 = 578.4$  |  $5784 \div 1000 = 5.784$   
 $5784 \div 100 = 57.84$  |  $5784 \div 10000 = .5784$

## *Contracted* DIVISION of DECIMALS.

### RULE.

**BY** the first rule find what is the value of the first figure in the quotient; then by knowing the first figure's denomination, the decimal places may be reduced to any number, by taking as many of the left-hand figures of the dividend as will answer them; and, in dividing, omit one figure of the divisor at each following operation.

NOTE. That in multiplying every figure left out in the divisor, you must carry 1, if it be 5, or upwards to 15; if 15, or upwards to 25, carry 2; if 25, or upwards to 35, carry 3, &c.

### EXAMPLES.

(<sup>12</sup>) Divide 721.17562 by 2.257432, and let there be only 3 places of decimals in the quotient.

Contracted.	Common way.
2,257432)721,17562(319,467	2,257432)721,17562(319,467
6772296	6772296
439460 .	439460 2
225743 .	225743 2
213717 ..	213717 00
203169 ..	203168 88
10548 ...	10548 120
9030 ...	9029 728
1518 ....	1518 3920
1354 ....	1354 4592
164 .....	163 93280
158 .....	158 02024
6	591256

- (13) Divide 8,758615 by 5,2714167.  
 (14) Divide 51717591 by 8,7586.  
 (15) Divide 25,1357 by 217,35.  
 (16) Divide 51,47542 by 123415.  
 (17) Divide 70,23 by 7,9863.  
 (18) Divide 27,104 by 3,1712.

## REDUCTION OF DECIMALS.

### 1. To reduce a Vulgar Fraction to a Decimal.

#### RULE.

ADD cyphers to the numerator, and divide by the denominator, the quotient is the decimal fraction required.

#### EXAMPLES.

- (1) Reduce  $\frac{1}{4}$  - - - to a decimal. 4)1,00(.25 facit.  
 (2) Reduce  $\frac{1}{2}$  - - - to a decimal. facit ,5.  
 (3) Reduce  $\frac{3}{4}$  - - - to a decimal. facit ,75.  
 (4) Reduce  $\frac{3}{8}$  - - - to a decimal. facit ,375.  
 (5) Reduce  $\frac{5}{28}$  - - - to a decimal. facit ,1923076+.  
 (6) Reduce  $\frac{1}{14}$  of  $\frac{1}{3}$  to a decimal. facit ,6043956+.

*Note,* If the given parts are of several denominations, they may be reduced either by so many distinct operations, as there are different parts, or by first reducing them into their lowest denominations, and then divide as before; or

2<sup>dly</sup>, Bring the lowest into decimals of the next superior denomination, and on the left hand of the decimal found, place the parts given of the next superior denomination; so proceeding till you bring out the decimal parts of the highest integer required, by still dividing the product by the next superior denominator; or,

3<sup>dly</sup>, To reduce shillings, pence, and farthings. If the number of shillings be even, take half for the first place of decimals, and let the second and third places be filled up with the farthings contained in the remaining pence and farthings. always remembering to add 1, when it is or exceeds 25. But if the number of shillings be odd, the second place or decimals must be increased by 5. Next divide half the number of farthings in the pence and farthings (rejecting 24 or 6<sup>d</sup>. if there be 6<sup>d</sup>.) by 12; the quotient, written after the 3 places before found, will give the decimal required.

(7) Reduce 5s. to the decimal of a £. *facit* ,25.

(8) Reduce 9s. to the decimal of a £. *facit* ,45.

(9) Reduce 16s. to the decimal of a £. *facit* ,8.

(10) Reduce 8s. 4d. to the decimal of a £. *facit* ,416.

(11) Reduce 16s. 7½d. to the decimal of a £. *facit* ,8322916.

<i>first.</i>	<i>second.</i>	<i>third.</i>	
16s. 7½d.	4)3,00	2)16	7¾
12	<u>          </u>	<u>          </u>	4
—	12)7.75	<u>832</u>	—
199	<u>          </u>	<u>          </u>	32
4	2)0)16,64583		<u>          </u>
<u>          </u>	<u>          </u>		
960)799(,8322916	<u>.8322916</u>		

(12) Reduce 19s. 5½d. to the decimal of a £.

*facit* ,972916.

(13) Reduce 12 grains to the decimal of a lb. Troy.

*facit* ,002083.

(14) Reduce 12 drams to the decimal of a lb. Avoirdupoise.

*facit* ,046875.

(15) Reduce 2 qrs. 14 lb. to the decimal of an cwt.

*facit* ,62.



(16) Reduce 2 furlongs to the decimal of a league.

*facit* ,0833.

(17) Reduce 2 quarts 1 pint to the decimal of a gallon.

*facit* ,625

(18) Reduce 4 gallons 2 quarts of wine, to the decimal of a hoghead.

*facit* ,071428+.

(19) Reduce 2 gallons 1 quart of beer, to the decimal of a barrel.

*facit* ,0625.

(20) Reduce 52 days to the decimal of a year.

*facit* ,142465+.

2. To find the value of any Decimal Fraction, in the known parts of an integer.

RULE. Multiply the decimal given, by the number of parts of the next inferior denomination, cutting off the decimals from the product; then multiply the remainder by the next inferior denomination; thus proceeding till you have brought the least known parts of the integer.

EXAMPLES.

(21) What is the value of ,8322916 of a £. *Ans.* 16s. 7½d. +

$$\begin{array}{r}
 \phantom{16,6458320} \\
 \hline
 16,6458320 \\
 \phantom{16,6458320} 12 \\
 \hline
 7,7499840 \\
 \phantom{7,7499840} 4 \\
 \hline
 \phantom{7,7499840} \frac{1}{2},9999360 \\
 \hline
 \hline
 \end{array}$$

(22) What is the value of ,002083 of a lb. Troy!

*Ans.* 12 grs.

(23) What is the value of ,046875 of a lb. Avoirdupoise?

*Ans.* 12 drams.

(24) What is the value of ,625 of a cwt.?

*Ans.* 2 grs. 14 lb.

(25) What is the value of ,625 of a gallon?

*Ans.* 2 quarts, 1 pint.

(26) What is the value of ,071428+ of a hoghead of wine?

*Ans.* 4 gal. 2 quarts.

(27) What is the value of ,0625 of a barrel of beer?

*Ans.* 2 gallons, 1 quart.

(28) What is the value of ,142465+ of a year?

*Ans.* 52 days.

# Decimal TABLES of COIN, WEIGHT, and MEASURE.

TABLE I.  
ENGLISH COIN.  
1 £ the Integer.

Sb.	dec.	Sb.	dec.
19	,95	9	,45
18	,9	8	,4
17	,85	7	,35
16	,8	6	,3
15	,75	5	,25
14	,7	4	,2
13	,65	3	,15
12	,6	2	,1
11	,55	1	,05
10	,5		

Pence.	Decimals.
6	,025
5	,020833
4	,016666
3	,0125
2	,008333
1	,004166

Farthrs.	Decimals.
3	,003125
2	,0020833
1	,0010416

TABLE II.  
ENG. COIN 1 Sb.  
Long Meas. 1 Foot  
the Integer.

Pence and Inches.	Decimals.
6	,5
5	,416666
4	,333333
3	,25
2	,166666
1	,083333

Farthrs.	Decimals.
3	,0625
2	,041666
1	,020833

TABLE III.  
TROY WEIGHT  
1 lb. the Integer.  
Ounces the same as  
Pence in the last  
Table.

Penny- weight	Decimals.
10	,041666
9	,0375
8	,033333
7	,029166
6	,025
5	,020833
4	,016666
3	,0125
2	,008333
1	,004166

Grains.	Decimals.
12	,002083
11	,001910
10	,001736
9	,001562
8	,001389
7	,001215
6	,001042
5	,000868
4	,000694
3	,000521
2	,000347
1	,000173

1 Oz. the Integer.  
Penny weights the  
same as Shillings  
in the first Table.

Grains.	Decimals
12	,025
11	,022916
10	,020833
9	,01875
8	,016666
7	,014583
6	,0125
5	,010416
4	,008333
3	,00625
2	,004166
1	,002083

TABLE IV.  
AVOIRDUP. WT.  
112 lb. the Integer.

Qrs.	Decimals.
3	,75
2	,5
1	,25

Pounds	Decimals.
14	,125
13	,116071
12	,107143
11	,098214
10	,089286
9	,080357
8	,071428
7	,0625
6	,053571
5	,044643
4	,035714
3	,026786
2	,017857
1	,008928

Ounces.	Decimals.
8	,004464
7	,003906

# Decimal TABLES of COIN, WEIGHT, and MEASURE.

6	,003348	80	,317460
5	,002790	70	,27777
4	,002232	60	,238095
3	,001674	50	,198412
2	,001116	40	,158730
1	,000558	30	,119047
		20	,079365
		10	,039682
		9	,035714
		8	,031746
		7	,027777
		6	,023809
		5	,019841
		4	,015873
		3	,011904
		2	,007936
		1	,003968

$\frac{1}{4}$ Oz.	Decimals.
3	,000418
2	,000279
1	,000139

TABLE V.  
AVOIRDUPOIS WT.  
1 lb. the Integer.

Ounces.	Decimals.
8	,5
7	,4375
6	,375
5	,3125
4	,25
3	,1875
2	,125
1	,0625

Drams.	Decimals.
8	,03125
7	,027343
6	,023437
5	,019531
4	,015625
3	,011718
2	,007812
1	,003906

TABLE VI.  
LIQUID MEAS.  
1 tun the Integer.

Gallons.	Decimals.
100	,396825
90	,357141

Pints.	Decimals.
4	,001984
3	,001488
2	,000992
1	,000496

A Hogshead the  
Integer.

Gallons.	Decimals.
30	,476190
20	,317460
10	,158730
9	,142857
8	,126984
7	,111111
6	,095238
5	,079365
4	,063492
3	,047619
2	,031746
1	,015873

Pints.	Decimals.
3	,005952
2	,003968
1	,001984

TABLE VII.  
MEASURE.  
Liquid. Dry.  
1 Gallon. 1 Quarter.  
Integer.

Pint.	Dec.	Bufs.
4	,5	4
3	,375	3
2	,25	2
1	,125	1

$\frac{1}{2}$ pt.	Dec.	Pk.
3	,09375	3
2	,0625	2
1	,03125	1

Decimals.	$\frac{1}{2}$ pks.
,0234375	3
,015625	2
,0078125	1

Decimals.	Pints.
,005859	3
,003906	2
,001953	1

TABLE VIII.  
LONG MEASURE.  
1 mile the Integer.

Yards.	Decimals.
1000	,568182
900	,511364
800	,454545
700	,397727
600	,340909

# Decimal TABLES of COIN, WEIGHT, and MEASURE

500	,284091
400	,227272
300	,170454
200	,113636
100	,056818
90	,051136
80	,045454
70	,039773
60	,034091
50	,028409
40	,022727
30	,017045
20	,011364
10	,005682
9	,005114
8	,004545
7	,003977
6	,003409
5	,002841
4	,002273
3	,001704
2	,001136
1	,000568

<i>Feet.</i>	<i>Decimals.</i>
2	,0003787
1	,0001894

<i>Inches.</i>	<i>Decimals.</i>
6	,0000947
3	,0000474
1	,0000158

TABLE IX.  
TIME.  
1 Year the Integer  
*Months the same as*  
*Pence in the second*  
*Table.*

<i>Days.</i>	<i>Decimals.</i>
365	1,0000000
300	,821918
200	,547945
100	,273973
90	,246575

80	,219178
70	,191781
60	,164383
50	,136986
40	,109589
30	,082192
20	,054794
10	,027397
9	,024657
8	,021918
7	,019178
6	,016438
5	,013698
4	,010959
3	,008219
2	,005479
1	,002739

1 Day the Integer.

<i>Hours.</i>	<i>Decimals.</i>
12	,5
11	,458333
10	,416666
9	,375
8	,333333
7	,291666
6	,25
5	,208333
4	,166666
3	,125
2	,083333
1	,041666

<i>Minut.</i>	<i>Decimals.</i>
30	,020833
20	,013888
10	,006944
9	,00625
8	,005555
7	,004861
6	,004166
5	,003472
4	,002777
3	,002083
2	,001388
1	,000694

TABLE X.  
CLOTH MEASURE.  
1 Yard the Integer.  
*Qrs. the same as*  
*Table 4.*

<i>Nails.</i>	<i>Decimals.</i>
2	,125
1	,0625

TABLE XI.  
LEAD WEIGHT.  
A Fother the Integer.

<i>Hund.</i>	<i>Decimals.</i>
10	,512820
9	,461538
8	,410256
7	,358974
6	,307692
5	,256410
4	,205128
3	,153846
2	,102564
1	,051282

<i>Qrs.</i>	<i>Decimals.</i>
2	,025641
1	,012820

<i>Pounds.</i>	<i>Decimal.</i>
14	,0064102
13	,0059523
12	,0054945
11	,0050366
10	,0045787
9	,0041208
8	,0036630
7	,0032051
6	,0027472
5	,0022893
4	,0018315
3	,0013736
2	,0009157
1	,0004578



The RULE of THREE in DECIMALS.

EXAMPLES.

(1) IF  $26\frac{1}{2}$  yards cost  $3l. 16s. 6d.$ —what will  $32\frac{1}{2}$  yards come to? *Yds.      £.      Yds.      Ans. £4 : 12 : 9½.*

$$\begin{array}{r} 26,5 : 3,8125 :: 32,25 \\ \hline 32,25 \end{array}$$

$$26,5)122,953125(4,63974 = £4 : 12 : 9\frac{1}{2}.$$

(2) What will the pay of 540 men come to at  $1l. 5s. 6d.$  per man? *Ans. £ 688 : 10s.*

(3) If  $7\frac{3}{4}$  yards of cloth cost  $2l. 12s. 9d.$ —what will  $140\frac{1}{2}$  yards of the same cost? *Ans. £ 47 : 16 : 3 : 2 + qrs.*

(4) If a chest of sugar, weighing 7 cwt. 2 qrs. 14 lb. cost  $36l. 12s. 9d.$ —what will 2 cwt. 1 qr. 21 lb. of the same cost? *Ans. £ 11 : 14 : 2 + qrs.*

(5) A grocer buys 24 ton, 12 cwt. 2 qrs. 14 lb. 12 oz. of tobacco for  $3678l. 6s. 4d.$ —what will 1 oz. come to? *Ans. 1d.*

(6) What will 326 lb. 1 qr. of tobacco come to, when  $1\frac{1}{2}lb.$  is sold for  $3s. 6d.$  *Ans. £ 38 : 1 : 3.*

(7) What is the worth of 19 oz. 3 dwts. 5 gr. of gold, at  $2l. 19s. per oz.$  *Ans. £ 56 : 10 : 5½.*

(8) What is the worth of  $827\frac{3}{4}$  yards of painting at  $10\frac{1}{2}d. per yard?$  *Ans. £ 36 : 4 : 3 : 1, + qrs.*

(9) If I lent my friend  $34l.$  for  $\frac{5}{8}$  of a year—how much ought he to lend me  $\frac{5}{7}$  of a year to requite my kindness? *Ans. £ 51.*

(10) If  $\frac{1}{4}$  of a yard of cloth, that is  $2\frac{1}{4}$  yards broad, make a garment—how much that is  $\frac{2}{3}$  of a yard wide will make the same? *Ans. 2,169375 yards.*

(11) If 1 oz. of silver cost  $5s. 6d.$ —what is the price of a tankard that weighs 1 lb. 10 oz. 10 dwt. 4 grs.? *Ans. £ 6 : 3 : 9 : 2, + qrs.*

(12) If 1 lb. of tobacco cost  $15d.$  what cost 3 hogheads, weighing together 15 cwt. 1 qr. 19 lb.? *Ans. £ 107 : 18 : 9.*

(13) If 1 cwt. of currants cost  $2l. 9s. 6d.$ —what will 45 cwt. 3 qrs. 14 lb. cost at the same rate? *Ans. £ 113 : 10 : 9 : 3 qrs.*

(14) Bought 6 chests of sugar, each 6 cwt. 3 qrs. at  $2l. 16s. per cwt.$ —what do they come to? *Ans. £ 113 : 8s.*

(14) Bought a tankard for  $10l. 12s.$  at the rate of  $5s. 4d. per ounce$ —what was the weight? *Ans. 39 oz. 15 dwts.*

# 132      *Extraction of the Square Root.*

(<sup>16</sup>) Gave 187*l.* 3*s.* 3*d.* for 25 cwt. 3 qrs. 14 lb. of tobacco—at what rate did I buy it at *per lb.*?    *Ans.* 15½*d.*

(<sup>17</sup>) Bought 29 lb. 4 oz. of coffee for 10*l.* 11*s.* 3*d.*—what is the value of 3 lb.?    *Ans.* £1:1:8.

(<sup>18</sup>) If I gave 1*s.* 1*d.* for 3½ lb. of cheese—what will be the value of 1 cwt.?    *Ans.* £1:14:8.

## EXTRACTION *of the* SQUARE ROOT.

**E**XTRACTING the Square Root is to find out such a number as being multiplied into itself, the product will be equal to the given number.

**RULE 1<sup>st</sup>,** Point the given number, beginning at the unit's place, then to the hundreds, and so upon every second figure throughout.

**2<sup>dly</sup>,** Seek the greatest square number in the first point towards the left-hand, placing the square number under the first point, and the root thereof in the quotient, subtract the square number from the first point, and to the remainder bring down the next point, and call that the *Resolvend*.

**3<sup>dly</sup>,** Double the quotient, and place it for a divisor on the left-hand of the resolvend, seek how often the divisor is contained in the resolvend, (preserving always the unit's place) and put the answer in the quotient, and also on the right-hand side of the divisor; then multiply by the figure last put in the quotient, and subtract the product from the resolvend; bring down the next point to the remainder (if there be any more) and proceed as before.

Roots.            1.   2.   3.   4.   5.   6.   7.   8.   9.

Squares.        1.   4.   9. 16. 25. 36. 49. 64. 81.

### EXAMPLES.

(<sup>1</sup>) What is the square root of 119025?    *Ans.* 345.

119025(345

9

---

64)290

256

---

685)3425

3425

---

(<sup>2</sup>) What

(2) What is the square root of 106929?      *Ans.* 327.

(3) What is the square root of 2268741?      *Ans.* 1506 43+.

(4) What is the square root of 7596796?      *Ans.* 2756 228+.

(5) What is the square root of 36372561?      *Ans.* 6031.

(6) What is the square root of 22071204?      *Ans.* 4698.

When the given number consists of a whole number, and decimals together, make the number of decimals even, by adding cyphers to them; so that there may be a point fall on the unit's plate of the whole number.

(7) What is the square root of 3271,4207?      *Ans.* 57,19+.

(8) What is the square root of 4795,25731?      *Ans.* 69,247+.

(9) What is the square root of 4,372594?      *Ans.* 2,091+.

(10) What is the square root of 2,2710957?      *Ans.* 1,50701+.

(11) What is the square root of ,00032754?      *Ans.* 0,1809+.

(12) What is the square root of 1,270054?      *Ans.* 1,1269+.

*To extract the Square root of a VULGAR FRACTION.*

**RULE.** Reduce the Fraction to its lowest terms; then extract the square root of the numerator for a new numerator, and the square root of the denominator for a new denominator.

*If the fraction be a surd (i. e.) a number where a root can never be exactly found, reduce it to a decimal, and extract the root of it.*

#### EXAMPLES.

(13) What is the square root of  $\frac{2304}{3184}$ ?      *Ans.*  $\frac{2}{3}$ .

(14) What is the square root of  $\frac{2704}{2424}$ ?      *Ans.*  $\frac{4}{3}$ .

(15) What is the square root of  $\frac{9216}{12344}$ ?      *Ans.*  $\frac{6}{7}$ .

#### SURDS.

(16) What is the square root of  $\frac{275}{341}$ ?      *Ans.* ,89802+.

(17) What is the square root of  $\frac{337}{476}$ ?      *Ans.* ,86602+.

(18) What is the square root of  $\frac{478}{349}$ ?      *Ans.* ,93309+.

*To extract the square root of a mixed number.*

**RULE. 1.** Reduce the fractional part of the mixed number to its lowest term, and then the mixed number to an improper fraction.

**2.** Extract the roots of the numerator and denominator for a new numerator and denominator.

## 134 *Extraction of the Square Root.*

*If the mixed number given be a surd, reduce the fractional part to a decimal, annex it to the whole number, and extract the square root thereof.*

### EXAMPLES.

- (<sup>19</sup>) What is the square root of  $51\frac{21}{25}$ ? *Ans.*  $7\frac{1}{5}$ .  
 (<sup>20</sup>) What is the square root of  $27\frac{9}{16}$ ? *Ans.*  $5\frac{1}{4}$ .  
 (<sup>21</sup>) What is the square root of  $9\frac{1}{9}$ ? *Ans.*  $3\frac{1}{3}$ .

### SURDS.

- (<sup>22</sup>) What is the square root of  $85\frac{14}{25}$ ? *Ans.*  $9,27+$ .  
 (<sup>23</sup>) What is the square root of  $8\frac{5}{7}$ ? *Ans.*  $2,9519+$ .  
 (<sup>24</sup>) What is the square root of  $6\frac{2}{3}$ ? *Ans.*  $2,5298+$ .

### *The APPLICATION.*

(<sup>1</sup>) There is an army consisting of a certain number of men, who are placed rank and file (that is, in the form of a square, each side having 576 men)—I desire to know how many the whole square contains? *Ans.* 331776.

(<sup>2</sup>) A certain pavement is made exactly square, each side of which contains 97 feet—I demand how many square feet are contained therein? *Ans.* 9409.

*To find the mean proportional between any two given numbers.*

**RULE.** The square root of the product of the given numbers is the mean proportional sought.

### EXAMPLES.

(<sup>3</sup>) What is the mean proportion between 3 and 12?  
 $3 \times 12 = 36$ , then  $\sqrt{36} = 6$ , the mean proportional.

(<sup>4</sup>) What is the mean proportional between 4276 and 842? *Ans.* 1897,4+.

*To find the side of a square equal in area to any given superficies.*

**RULE.** The square root of the content of any given superficies, is the square equal sought.

### EXAMPLES.

(<sup>5</sup>) If the content of a given circle be 160—what is the side of the square? *Ans.* 12,64911.

(<sup>6</sup>) If the area of a circle be 750—what is the side of the square equal? *Ans.* 27,38612.

*The area of a circle given to find the diameter.*

**RULE.** As 355:452, or, as 1:1,273239:: the area to the square of the diameter:—or, multiply the square  
 root



## Extraction of the Square Root. 135

root of the area, by 1,12837, and the product will be the diameter.

### EXAMPLE.

(<sup>7</sup>) What length of cord will be fit to tie to a cow's tail, the other end fixed in the ground, to let her have liberty of eating an acre of grass, and no more, supposing the cow and tail to be  $5\frac{1}{2}$  yards? *Ans.* 6,136 + perches.

*The area of a circle given to find the periphery or circumference.*

**RULE.** As 113 : 1420, or, as 1 : 12,56637 :: the area to the square of the periphery:—or, multiply the square root of the area by 3,5449, and the product is the circumference.

### EXAMPLES.

(<sup>8</sup>) When the area is 12—what is the circumference? *Ans.* 12,2798.

(<sup>9</sup>) When the area is 160—what is the periphery? *Ans.* 44,839.

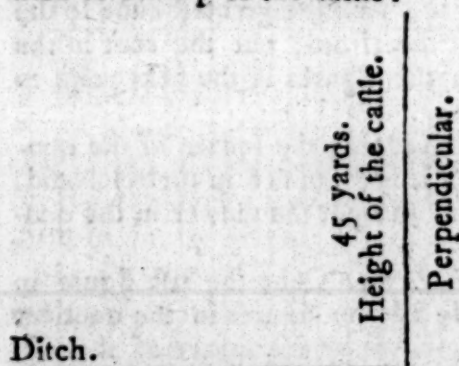
Any two sides of a right-angled triangle given to find the third side.

1. *The base and perpendicular given to find the hypotenuse.*

**RULE.** The square root of the sum of the squares of the base and perpendicular is the length of the hypotenuse.

### EXAMPLES.

(<sup>10</sup>) The top of a castle from the ground is 45 yards high, and surrounded with a ditch of 60 yards broad; what length must a ladder be to reach from the outside of the ditch to the top of the castle? *Ans.* 75 yards.



Base 60 yards.

(<sup>11</sup>) The wall of a town is 25 feet high, which is surrounded by a moat of 30 feet in breadth—I desire to know

the length of a ladder that will reach from the outside of the moat to the top of the wall. *Ans.* 39,05 + feet.

2. *The hypotenuse and perpendicular given to find the base.*

**RULE.** The square root of the difference of the squares of the hypotenuse and perpendicular is the length of the base.

3. *The base and hypotenuse given to find the perpendicular.*

**RULE.** The square root of the difference of the squares of the hypotenuse and base is the height of the perpendicular.

☞ *The two last questions may be varied for examples to the two last propositions.*

Any number of men being given to form them into a square battalia, or to find the number of rank and file.

**RULE.** The square root of the number of men given, is the number of men either in rank or file.

(<sup>12</sup>) An army consisting of 331776 men—I desire to know how many rank and file? *Ans.* 576.

(<sup>13</sup>) A certain square of pavement contains 48841 square stones all of the same size—I demand how many are contained in one of the sides? *Ans.* 221.

### EXTRACTION of the CUBE ROOT.

**TO** extract the cube root is to find out a number, which being multiplied into itself, and then into that product, produceth the given number.

**RULE 1.** Point every third figure of the cube given, beginning at the unit's place; seek the greatest cube to the first point, and subtract it therefrom; put the root in the quotient, and bring down the figures in the next point to the remainder for a *resolvend*.

2. Find a *divisor*, by multiplying the square of the quotient by 3. See how often it is contained in the resolvend, rejecting the units and tens, and put the answer in the quotient.

3. To find the *subtrahend*. 1. Cube the last figure in the quotient. 2. Multiply all the figures in the quotient by 3, except the last and product by the square of the last. 3. Multiply the divisor by the last figure. Add these products together, gives the subtrahend; which subtract from the resolvend; to the remainder bring down the next point and proceed as before.

**Rcors.**

ROOTS.	1.	2.	3.	4.	5.	6.	7.	8.	9.
CUBES.	1.	8.	27.	64.	125.	216.	343.	512.	729.

EXAMPLES.

(1) What is the cube root of 99252847?

$$\begin{array}{r}
 99252847(463 \\
 64 = \text{cube of } 4. \\
 \hline
 \text{Divisor} \quad \text{Square of } 4 \times 3 = 48) 35252 \text{ resolvend.} \\
 \hline
 216 = \text{cube of } 6. \\
 432 = 4 \times 3 \times \text{by square of } 6. \\
 288 = \text{divisor} \times \text{by } 6. \\
 \hline
 33336 \text{ subtrahend.} \\
 \hline
 \text{Divisor} \quad \text{Sq. of } 46 \times 3 = 6348) 191687 \text{ resolvend.} \\
 \hline
 27 = \text{cube of } 3. \\
 1242 = 46 \times 3 \times \text{by square of } 3. \\
 19044 = \text{divisor} \times \text{by } 3. \\
 \hline
 1916847 \text{ subtrahend.} \\
 \hline
 \hline
 \end{array}$$

Another New and more Concise Method of extracting the  
CUBE ROOT.

**RULE 1.** Point every third figure of the cube given, beginning at the unit's place, then find the highest cube to the first point, and subtract it therefrom, put the root in the quotient, bring down the figures in the next point to the remainder for a resolvend.

2. Square the quotient, and triple the square for a divisor. As  $4 \times 4 \times 3 = 48$ . Find how often it is contained in the resolvend, rejecting units and tens, and put the answer in the quotient.

3. Square the last figure in the quotient, and put it on the right hand of the divisor.

As  $6 \times 6 = 36$  put to the divisor  $48 = 4836$ .

4. Triple the last figure in the quotient, and multiply by the former, put it under the other, units under the tens, add them together, and multiply the sum by the last figure in

M 3 the

quotient, subtract that product from the resolvend, bring down the next point, and proceed as before.

## EXAMPLES.

(<sup>1</sup>) What is the cube root of 99252847? . . .

Square of $4 \times 3 = 48$ divisor.	99252847(463
Square of 6 put to 48 = 4836	64
$6 \times 3 \times 4 = 72$	<hr/>
	35252
$5556 \times 6 =$	33336
Square of 46 = 2116 $\times 3 = 6348$ divisor	<hr/>
Square of 3 = 9 put to 6438 = *634809	1916847
$3 \times 3 \times 46 = 414$	<hr/>
	<hr/>
	<u>638949 <math>\times 3 = 1916847</math>.</u>

- (<sup>2</sup>) What is the cube root of 389017? *Ans.* 73.  
 (<sup>3</sup>) What is the cube root of 5735339? *Ans.* 179.  
 (<sup>4</sup>) What is the cube root of 32461759? *Ans.* 319.  
 (<sup>5</sup>) What is the cube root of 84604519? *Ans.* 439.  
 (<sup>6</sup>) What is the cube root of 259694072? *Ans.* 638.  
 (<sup>7</sup>) What is the cube root of 48228544? *Ans.* 364.  
 (<sup>8</sup>) What is the cube root of 27054036008? *Ans.* 3002.  
 (<sup>9</sup>) What is the cube root of 22069810125? *Ans.* 2805.  
 (<sup>10</sup>) What is the cube root of 122615327232? *Ans.* 4968.  
 (<sup>11</sup>) What is the cube root of 219365327791? *Ans.* 6031.  
 (<sup>12</sup>) What is the cube root of 673373097125? *Ans.* 8765.

When the given number consists of a whole number, and decimal together, make the number of decimals consist of 3, 6, 9, &c. places, by adding cyphers thereto, so that there may be a point fall in the unit's place of the whole number.

- (<sup>13</sup>) What is the cube root of 12,977875? *Ans.* 2,35.  
 (<sup>14</sup>) What is the cube root of 36155,027576? *Ans.* 33,08+.  
 (<sup>15</sup>) What is the cube root of ,001906624? *Ans.* ,124.  
 (<sup>16</sup>) What is the cube root of 33,230979637? *Ans.* 3,215+.  
 (<sup>17</sup>) What is the cube root of 15926,972504? *Ans.* 25,16+.  
 (<sup>18</sup>) What is the cube root of ,0531573,6? *Ans.* ,376.  
To

\* When the quotient is 2 or 3, there must be a cypher put to supply the place of tens.



*To extract the Cube Root of a Vulgar Fraction!*

**RULE.** Reduce the fraction to its lowest terms, then extract the cube root of its numerator and denominator, for a new numerator and denominator; but if the fraction be a furd, reduce it to a decimal, and then extract the root from it.

**EXAMPLES.**

- |   |                              |
|---|------------------------------|
| (19) What is the cube root of $\frac{250}{686}$ ?   | <i>Ans.</i> $\frac{5}{7}$ .  |
| (20) What is the cube root of $\frac{324}{1300}$ ?  | <i>Ans.</i> $\frac{3}{10}$ . |
| (21) What is the cube root of $\frac{1520}{3136}$ ? | <i>Ans.</i> $\frac{2}{3}$ .  |

**SURDS.**

- |   |                    |
|---|--------------------|
| (22) What is the cube root of $\frac{4}{7}$ ? | <i>Ans.</i> ,829+. |
| (23) What is the cube root of $\frac{5}{9}$ ? | <i>Ans.</i> ,822+. |
| (24) What is the cube root of $\frac{2}{3}$ ? | <i>Ans.</i> ,873+. |

*To extract the cube root of a mixed number.*

**RULE.** Reduce the fractional part to its lowest terms, and then the mixed number to an improper fraction, extract the cube roots of the numerator and denominator for a new numerator and denominator; but if the mixed number given be a furd, reduce the fractional part to a decimal, annex it to the whole number, and extract the root therefrom.

**EXAMPLES.**

- |   |                              |
|---|------------------------------|
| (25) What is the cube root of $12\frac{19}{27}$ ?   | <i>Ans.</i> $2\frac{1}{3}$ . |
| (26) What is the cube root of $31\frac{15}{343}$ ?  | <i>Ans.</i> $3\frac{1}{7}$ . |
| (27) What is the cube root of $405\frac{28}{125}$ ? | <i>Ans.</i> $7\frac{2}{5}$ . |

**SURDS.**

- |  |                     |
|--|---------------------|
| (28) What is the cube root of $7\frac{1}{5}$ ? | <i>Ans.</i> 1,93+.  |
| (29) What is the cube root of $9\frac{1}{6}$ ? | <i>Ans.</i> 2,092+. |
| (30) What is the cube root of $8\frac{5}{7}$ ? | <i>Ans.</i> 2,057+. |

*The APPLICATION.*

(1) If a cubical piece of timber be of 47 inches long, 47 inches broad, and 47 inches deep—how many cubical inches doth it contain? *Ans.* 103823.

(2) There is a cellar dug, that is 12 feet every way, in length, breadth, and depth—how many solid feet of earth were taken out of it? *Ans.* 1728.

(3) There is a stone of a cubic form, which contains 389017 solid feet—what is the superficial content of one of its sides? *Ans.* 5329.

*Between*

## 140 *Extracting of the Biquadrate Root.*

*Between two numbers given, to find two mean proportionals.*

**RULE.** Divide the greater extreme by the less, and the cube root of the quotient multiplied by the less extreme gives the less mean; multiply the said cube root by the less mean, and the product will be the greater mean proportional.

### EXAMPLES.

(<sup>1</sup>) What are the two mean proportionals between 6 and 162? *Ans.* 18 and 54.

(<sup>2</sup>) What are the two mean proportionals between 4 and 108? *Ans.* 12 and 36.

*To find the side of a cube that shall be equal in solidity to any given solid, as a globe, cylinder, prism, cone, &c.*

**RULE.** The cube root of the solid content of any solid body given, is the side of a cube of equal solidity.

### EXAMPLE.

(<sup>6</sup>) If the solid content of the globe is 10648—what is the side of a cube of equal solidity? *Ans.* 22.

*The side of the cube being given, to find the side of the cube that shall be double, treble, &c. in quantity to the cube given.*

**RULE.** Cube the side given, and multiply it by 2, 3, &c. the cube root of the product is the side sought.

### EXAMPLE.

(<sup>7</sup>) There is a cubical vessel, whose side is 12 inches, and it is required to find the side of another vessel that is to contain three times as much? *Ans.* 17,307.

## EXTRACTING of the BIQUADRATE ROOT.

**TO** extract the biquadrate root is to find out a number which being involved four times into itself will produce the given number.

**RULE.** First extract the square root of the given number; and then extract the square root of that square root, and it will give the biquadrate root required.

### EXAMPLES.

(<sup>1</sup>) What is the biquadrate of 27? *Ans.* 531441.

(<sup>2</sup>) What is the biquadrate of 76? *Ans.* 33362176.

(<sup>3</sup>) What is the biquadrate of 275? *Ans.* 5719140625.

(<sup>4</sup>) What is the biquadrate root of 531441? *Ans.* 27.

(<sup>5</sup>) What

## Extracting the Roots of all Power. 141

(<sup>5</sup>) What is the biquadrate root of 33362176? *Ans.* 76.

(<sup>6</sup>) What is the biquadrate root of 5719140625? *Ans.* 275.

*A general RULE for EXTRACTING the ROOTS of all POWERS.*

1. **P**REPARE the number given for extraction, by pointing off from the unit's place as the root required directs.

2. Find the first figure in the root by the table of powers, which subtract from the given number.

3. Bring down the first figure in the next point to the remainder, and call it the dividend.

4. Involve the root into the next inferior power to that which is given, multiply it by the given power, and call it the divisor.

5. Find a quotient figure by common division, and annex it to the root; then involve the whole root into the given power, and call that the subtrahend.

6. Subtract that number from as many points of the given power as are brought down, beginning at the lowest place, and to the remainder bring down the first figure of the next point for a new dividend.

7. Find a new divisor, and proceed in all respects as before.

### EXAMPLES.

(<sup>1</sup>) What is the square root of 141376?

$\begin{array}{r} \cdot \cdot \cdot \\ 141376(376 \\ \underline{9} \\ 6)51 \text{ dividend.} \\ \underline{1369} \text{ subtrahend.} \\ 74)447 \text{ dividend.} \\ \underline{141376} \text{ subtrahend.} \end{array}$	$\begin{array}{l} 3 \times \\ 37 \times \\ 37 \times \\ 376 \times \end{array}$	$\begin{array}{l} 2=6 \text{ divisor.} \\ 37=1369 \text{ subtrahend.} \\ 2=74 \text{ divisor.} \\ 376=141376 \text{ subtrahend.} \end{array}$
---	---	---

(<sup>1</sup>) What

(<sup>2</sup>) What is the cube root of 53157376 ?

$$\begin{array}{r} \cdot \quad \cdot \quad \cdot \\ 53157376(376 \\ \underline{27} \end{array}$$

27) 261 dividend

50653 subtrahend.

4107) 25043 dividend.

53157376 subtrahend.

3 × 3 × 3 = 27 divisor.

37 × 37 × 37 = 50653 subtrahend.

37 × 37 × 3 = 4107 divisor.

376 × 376 × 376 = 53157376 subtrahend.

(<sup>3</sup>) What is the biquadrate root of 19987173376 ?

$$\begin{array}{r} \cdot \quad \cdot \quad \cdot \quad \cdot \\ 19987173376(376 \\ \underline{81} \end{array}$$

108) 1188 dividend.

1874161 subtrahend.

202512) 1245563 dividend.

19987173376 subtrahend.

3 × 3 × 3 × 4 = 108 divisor.

37 × 37 × 37 × 37 = 1874161 subtrahend.

37 × 37 × 37 × 4 = 202512 divisor.

376 × 376 × 376 × 376 = 19987173376 subtrahend.

### SIMPLE INTEREST.

THERE are five letters to be observed in Simple Interest, *viz.*

P. the principal.

T. the time.

R. the ratio, or *rate per cent.*

I. the interest.


A. the amount.

A TABLE



## A TABLE of RATIOS.

3	,03	$5\frac{1}{2}$	,055	8	,08
$3\frac{1}{2}$	,035	6	,06	$8\frac{1}{2}$	,085
4	,04	$6\frac{1}{2}$	,065	9	,09
$4\frac{1}{2}$	,045	7	,07	$9\frac{1}{2}$	,095
5	,05	$7\frac{1}{2}$	,075	10	,1

 The ratio is the Simple Interest of 1*l.* for one year, at the rate per cent. proposed, and is found thus;

As 100:3::1:,03. As 100:3,5::1:,035.


When the principal, time, and rate per cent. are given to find the interest.

RULE. Multiply the principal, time, and rate together, and it will give the interest required.

NOTE. The proposition and rule are better expressed thus:

I. When P, R, T, are given to find I.

RULE.  $p \times r \times t = I$ .

 When two or more letters are put together like a word, they are to be multiplied one into another.

## EXAMPLES.

(<sup>1</sup>) What is the interest of 945*l.* 10*s.* for three years, at 5 per cent. per annum?

Ans. £945,5 × ,05 × 3 = 141,825 or £141:16:6.

(<sup>2</sup>) What is the interest of 547*l.* 14*s.* at 4 per cent. per annum, for 6 years?

Ans. £131:8:11 qrs.,08.

(<sup>3</sup>) What is the interest of 796*l.* 15*s.* at  $4\frac{1}{2}$  per cent. per annum, for 5 years?

Ans. £179:5:4:2 qrs.

(<sup>4</sup>) What is the interest of 397*l.* 9*s.* 5*d.* for  $2\frac{1}{2}$  years, at  $3\frac{1}{2}$  per cent. per annum?

Ans. 34:15:6. 3,5499 qrs.

(<sup>5</sup>) What is the interest of 554*l.* 17*s.* 6*d.* for 3 years, 8 months, at  $4\frac{1}{2}$  per cent. per ann?

Ans. £91:11*s.* 1—, 2 qrs.

(<sup>6</sup>) What is the interest of 236*l.* 18*s.* 8*d.* for 3 years, 8 months, at  $5\frac{1}{2}$  per cent. per annum?

Ans. £47:15:7. 2,2932 qrs.

When the interest is for any number of days only.

RULE. Multiply the interest of 1*l.* for one day, at the given rate by the principal and number of days, it will give the answer.

## INTEREST of 1%. for one DAY.

per cent.	Decimals.	per cent.	Decimals.
3	,00008219178	6½	,00017808219
3½	,00009589041	7	,00019178082
4	,00010958924	7½	,00020547945
4½	,00012328767	8	,00021917808
5	,00013698630	8½	,00023287671
5½	,00015068493	9	,00024657534
6	,00016438356	9½	,00026027397

NOTE. The above table is thus found.

As 365 : .03 :: 1 : .00008219178. And as 365 : .035 :: 1 : .00009589041, &c.

## EXAMPLES.

(7) What is the interest of 240*l.* for 120 days, at 4 per cent. per annum? *Ans.* .00010958904 × 240 × 120 = £ 3 : 3 : 1¼

(8) What is the interest of 563*l.* at 6 per cent. per annum, for 126 days? *Ans.* £ 11 : 13 : 2½.

(9) What is the interest of 560*l.* for 60 days, at 5 per cent. per annum? *Ans.* £ 4 : 12 : 0½.

(10) What is the interest of 364*l.* 18*s.* for 154 days, at 5 per cent. per annum? *Ans.* £ 7 : 13 : 11¼.

(11) What is the interest of 725*l.* 15*s.* for 74 days, at 4 per cent per annum? *Ans.* £ 5 : 17 : 8½.

(12) What is the interest of 100*l.* from the 1st of June, 1796, to the 9th of March following, at 5 per cent. per annum? *Ans.* £ 3 : 16 : 11¼.

II. When P, R, T, are given to find A.

RULE.  $prt + p = A$ ,

## EXAMPLES.

(13) What will 279*l.* 12*s.* amount to in 7 years, at 4½ per cent. per annum? *Ans.* £ 367 : 14 : 5. 3,04 qrs.

$$279,6 \times .045 \times 7 + 279,6 = 367,674.$$

(14) What will 320*l.* 17*s.* amount to in 5 years, at 3½ per cent. per annum? *Ans.* £ 367 : 19 : 11. 2,8 qrs.

(15) What will 679*l.* 13*s.* amount to in 6 years, at 5 per cent. per annum? *Ans.* £ 883 : 10 : 10. 3,2 qrs.

When there is any odd time given with the whole years, reduce the odd time into days, and work with the decimal parts of a year which are equal to those days.

(16) What will 926*l.* 12*s.* amount to in  $5\frac{1}{2}$  years, at 4 per cent. per annum? *Ans.* £1130 : 9*s.* 1,92 *qrs.*

(17) What will 368*l.* 16*s.* amount to in  $7\frac{1}{2}$  years, at  $6\frac{1}{2}$  per cent. per annum? *Ans.* £554 : 11 : 7. 3,68 *qrs.*

(18) What will 273*l.* 18*s.* amount to in 4 years, 175 days, at 3 per cent. per annum?

*Ans.* £310 : 14 : 1. 3,35080064 *qrs.*

III. When, A, R, T, are given to find P.

$$\text{RULE. } \frac{a}{tr+1} = P.$$

## EXAMPLES.

(19) What principal being put to interest will amount to 367*l.* 13*s.* 5*d.* 3,04 *qrs.* in 7 years, at  $4\frac{1}{2}$  per cent. per annum?

*Ans.*  $367,674 \div 1,315 = £279 : 12*s.*$

(20) What principal being put to interest, will amount to 376*l.* 19*s.* 11*d.* 2,8 *qrs.* in 5 years, at  $3\frac{1}{2}$  per cent. per annum?

*Ans.* £320 : 17*s.*

(21) What principal being put to interest, will amount to 883*l.* 10*s.* 10*d.* 3,2 *qrs.* in 6 years, at 5 per cent. per annum?

*Ans.* £679 : 13*s.*

(22) What principal being put to interest, will amount to 1130*l.* 9*s.* 1,92 *qrs.* in  $5\frac{1}{2}$  years, at 4 per cent. per annum?

*Ans.* £926 : 12*s.*

(23) What principal will amount to 554*l.* 11*s.* 7*d.* 3,68 *qrs.* in  $7\frac{1}{2}$  years, at  $6\frac{1}{2}$  per cent. per annum?

*Ans.* £368 : 16*s.*

(24) What principal will amount to 310*l.* 14*s.* 1*d.* 3,35080064 *qrs.* in 4 years 175 days, at 3 per cent. per annum?

*Ans.* £273 : 18*s.*

IV. When A, P, T, are given to find R.

$$\text{RULE. } \frac{a-p}{pt} = R.$$

## EXAMPLES.

(25) At what rate per cent. will 279*l.* 12*s.* amount to 367*l.* 13*s.* 5*d.* 3,04 *qrs.* in 7 years?

$367,674 - 279,6 = 88,074$ , and  $279,6 \times 7 = 1957,2$ .  
then  $88,074 \div 1957,2 = ,045$  or  $4\frac{1}{2}$  per cent. *Ans.*

(26) At what rate per cent. will 320*l.* 17*s.* amount to 376*l.* 19*s.* 11*d.* 2,8 *qrs.* in 5 years?

*Ans.*  $3\frac{1}{2}$  per cent.

(27) At what rate per cent. will 679*l.* 13*s.* amount to 883*l.* 10*s.* 10*d.* 3,2 *qrs.* in 6 years?

*Ans.* 5 per cent.

N

(-3) At

(<sup>28</sup>) At what rate *per cent.* will 926*l.* 12*s.* amount to 1130*l.* 9*s.* 1,92 *qrs.* in  $5\frac{1}{2}$  years? *Ans.* 4 *per cent.*

(<sup>29</sup>) At what rate *per cent.* will 368*l.* 16*s.* amount to 554*l.* 11*s.* 7*d.* 3,68 *qrs.* in  $7\frac{3}{4}$  years? *Ans.*  $6\frac{1}{2}$  *per cent.*

(<sup>30</sup>) At what rate *per cent.* will 273*l.* 18*s.* amount to 310*l.* 14*s.* 1*d.* 3,35080064 *qrs.* in 4 years, 175 days? *Ans.* 3 *per cent.*

V. When A, P, R. are given to find T.

$$\text{RULE. } \frac{a-p}{pr} = T.$$

#### EXAMPLES.

(<sup>31</sup>) In what time will 279*l.* 12*s.* amount to 367*l.* 13*s.* 5*d.* 3,04 *qrs.* at  $4\frac{1}{2}$  *per cent.*?  $367,674 - 279,6 = 88,074$ ,  $279,6 \times ,045 = 12,5820$ , then  $88,074 \div 12,5820 = 7$  years *Ans.*

(<sup>32</sup>) In what time will 320*l.* 17*s.* amount to 376*l.* 19*s.* 11*d.* 2,8 *qrs.* at  $3\frac{1}{2}$  *per cent.*? *Ans.* 5 years.

(<sup>33</sup>) In what time will 679*l.* 13*s.* amount to 883*l.* 10*s.* 10*d.* 3,2 *qrs.* at 5 *per cent.*? *Ans.* 6 years.

(<sup>34</sup>) In what time will 926*l.* 12*s.* amount to 1130*l.* 9*s.* 1,92 *qrs.* at 4 *per cent.*? *Ans.*  $5\frac{1}{2}$  years.

(<sup>35</sup>) In what time will 368*l.* 16*s.* amount to 554*l.* 11*s.* 7*d.* 3,68 *qrs.* at  $6\frac{1}{2}$  *per cent.*? *Ans.*  $7\frac{3}{4}$  years.

(<sup>36</sup>) In what time will 273*l.* 18*s.* amount to 310*l.* 14*s.* 1*d.* 3,35080064 *qrs.* at 3 *per cent.*? *Ans.* 4 years 175 days.

#### ANNUITIES, or PENSIONS, &c. in ARREARS.

Annuities or pensions, &c. are said to be in arrears, when they are payable or due, either yearly, half-yearly, or quarterly, and are unpaid for any number of payments.

NOTE. U represents the annuity, pension, or yearly rent, T, R, A, as before.

I. When U, R, T, are given to find A.

$$\text{RULE. } \frac{tu - tu}{2} \times r : + tu = A.$$

#### EXAMPLES.

(<sup>37</sup>) If a salary of 150*l.* be forborne 5 years, at 5 *per cent.* — what would it amount to? *Ans.* £825.

$$\frac{150 \times 5 - 5 \times 150 = 3000}{2} \times ,05 + 5 \times 150 = 825.$$



(38) If 250*l.* yearly pension be forborne 7 years what will it amount to in that time at 6 *per cent.*? *Ans.* £2065.

(39) There is a house let upon a lease for  $5\frac{1}{2}$  years, at 60*l.* *per annum*—what will be the amount of the whole time, at  $4\frac{1}{2}$  *per cent.*? *Ans.* £363 : 8 : 3.

(40) Suppose an annual pension of 28*l.* remain unpaid for 8 years—what would it amount to at 5 *per cent.*? *Ans.* £263 : 4*s.*

Note. When the annuities, &c. are to be paid half-yearly, or quarterly, then

For half-yearly payments, take half of the ratio, half of the annuity, &c. and twice the number of years; and,

For quarterly payments, take a fourth part of the ratio, fourth part of the annuity, &c. and four times the number of years, and work as before.

## EXAMPLES.

(41) If a salary of 150*l.* payable every half year, remains unpaid for 5 years—what would it amount to in that time at 5 *per cent.*? *Ans.* £834 : 7 : 6.

(42) If a salary of 150*l.* payable every quarter, was left unpaid for 5 years—what would it amount to in that time, at 5 *per cent.*? *Ans.* £839 : 1 : 3.

Note. It may be observed, by comparing these last examples, the amount of the half-yearly payments are more advantageous than the yearly, and the quarterly more than the half-yearly.

II. When A, R, T, are given to find U.

$$\text{RULE. } \frac{2a}{1tr - tr + 2t} = U.$$

## EXAMPLES.

(43) If a salary amounted to 825*l.* in 5 years, at 5 *per cent.*—what was the salary? *Ans.* £150.

$825 \times 2 = 1650$ ,  $5 \times 5 \times .05 - 5 \times .05 + 5 \times 2 = 11$ , then  $1650 \div 11 = 150$ .

(44) If an house is to be let upon a lease for  $5\frac{1}{2}$  years, and the amount for that time be 363*l.* 8*s.* 3*d.* at  $4\frac{1}{2}$  *per cent.* what is the yearly rent? *Ans.* £60.

(45) If a pension amounted to 2065*l.* in 7 years, at 6 *per cent.*—what was the pension? *Ans.* £250.

(46) Suppose the amount of a pension be 263*l.* 4*s.* in 8 years, and at 5 *per cent.*—what is the pension? *Ans.* £28.

Note. When the payments are half-yearly, then take 4 a, half of the ratio, and twice the number of years; and if quarterly, then take 8 a, one fourth of the ratio, and four times the number of years, and proceed as before.

(47) If the amount of a salary, payable half-yearly, for 5 years, and at 5 per cent. be 834*l.* 7*s.* 6*d.*—what is the salary? *Ans.* £150.

(48) If the amount of the annuity, payable quarterly, be 839*l.* 1*s.* 3*d.* for 5 years, at 5 per cent.—what is the annuity? *Ans.* £150.

III. When U, A, T, are given to find R.

$$\text{RULE. } \frac{2a - 2ut}{ut - ut} = R.$$

#### EXAMPLES.

(49) If a salary of 150*l.* per annum, amount to 825*l.* in 5 years—what is the rate per cent.? *Ans.* 5 per cent.

$$825 \times 2 - 150 \times 5 \times 2 = 150 \text{ then } \frac{150}{150 \times 5 \times 5 - 150 \times 5} = .05$$

(50) If a house be let upon lease for 5½ years, at 60*l.* per annum, and the amount for that time be 363*l.* 8*s.* 3*d.* what is the rate per cent.? *Ans.* 4½ per cent.

(51) If a pension of 250*l.* per annum amounts to 2065*l.* in 7 years—what is the rate per cent.? *Ans.* 6 per cent.

(52) Suppose the amount of a yearly pension of 28*l.* be 263*l.* 4*s.* in 8 years—what is the rate per cent.? *Ans.* 5 per cent.

Note. When the payments are half yearly, take 4 a—4 ut for a dividend, and work with half the annuity, and double the number of years for a divisor; if quarterly, take 8 a—8 ut and work with a fourth of the annuity, and four times the number of years.

(53) If a salary of 150*l.* per annum, payable half-yearly, amounts to 834*l.* 7*s.* 6*d.* in 5 years—what is the rate per cent.? *Ans.* 5 per cent.

(54) If an annuity of 150*l.* per annum, payable quarterly, amounts to 839*l.* 1*s.* 3*d.* in 5 years—what is the rate per cent.? *Ans.* 5 per cent.

IV. When

IV. When U, A, R, are given to find T.

RULE First  $\frac{2}{r} - 1 = x$ , then  $\sqrt{\frac{2a}{ar} + \frac{xx}{4} - \frac{x}{2}} = T$ .

## EXAMPLES.

(55) In what time will a salary of 15*ol.* per annum amount to 82*5l.* at 5 per cent? *Ans.* 5 years.

$$\frac{2}{.05} - 1 = 39, \quad \frac{825 \times 2}{150 \times .05} = 220, \quad \frac{39 \times 39}{4} = 380,25, \text{ then}$$

$$\sqrt{220 + 380,25} = 24,5, \text{ and } 24,5 - \frac{39}{2} = 5 \text{ years.}$$

(56) If a house be let upon lease for a certain time for 6*ol.* per annum, and the amount be 363*l.* 8*s.* 3*d.* at 4½ per cent.—what time was it let for? *Ans.* 5½ years.

(57) If a pension of 25*ol.* per annum, being forborne a certain time, amounts to 206*5l.* at 6 per cent.—what was the time of forbearance? *Ans.* 7 years.

(58) In what time will a yearly pension of 28*l.* amount to 263*l.* 4*s.* at 5 per cent.? *Ans.* 8 years.

Note. If the payments are half-yearly, take half of the ratio and half the annuity; in quarterly, one fourth of the ratio, and one fourth of the annuity; and T will be equal to those half-yearly, or quarterly payments.

(59) If an annuity of 15*ol.* per annum payable half-yearly, amounts to 834*l.* 7*s.* 6*d.* at 5 per cent.—what time was the payment forborne? *Ans.* 5 years.

(60) If a yearly pension of 15*ol.* payable quarterly, amounts to 839*l.* 1*s.* 3*d.* at 5 per cent.—what was the time of forbearance. *Ans.* 5 years.

## PRESENT WORTH OF ANNUITIES.

NOTE. P represents the present worth; U, T, R, as before.

I. When U, T, R, are given to find P.

RULE.  $\frac{ttr - tr + 2t}{2tr + 2} : \times u = P$

N 3

EXAMPLES.

## EXAMPLES.

(61) What is the present worth of 150*l.* per annum, to continue 5 years, at 5 per cent. *Ans.* £660.

$$5 \times 5 \times .05 - 5 \times .05 + 5 \times 2 = 11.5 \times .05 \times 2 + 2 = 2.5$$

*then*  $11 \div 2.5$ , and  $\times 150 = £660$ .

(62) What is the yearly rent of a house of 60*l.* to continue  $5\frac{1}{2}$  years, worth in ready money, at  $4\frac{1}{2}$  per cent.?

*Ans.* £291:6:3.

(63) What is the present worth of 250*l.* per annum, to continue 7 years, at 6 per cent.?

*Ans.* £1454:4:6.

(64) What is a pension of 28*l.* per annum worth in ready money, at 5 per cent. for 8 years?

*Ans.* £188.

*The same thing is to be observed as in the first rule of annuities in arrears, concerning half-yearly and quarterly payments.*

(65) What is the present worth of 150*l.* payable half-yearly, for 5 years, at 5 per cent.?

*Ans.* £667:10s.

(66) What is the present worth of 150*l.* payable quarterly, for 5 years, at 5 per cent.?

*Ans.* £671:5s.

NOTE. By comparing the last examples it will be found, that the present worth of half-yearly payments is more advantageous than yearly; and quarterly than half-yearly.

II. When P, T, R, are given to find U.

$$\text{RULE. } \frac{tr+1}{tr-tr+2t} : \times 2p = U$$

## EXAMPLES.

(67) If the present worth of a salary be 660*l.* to continue 5 years, at 5 per cent. what was the salary?

*Ans.* £150.

$$5 \times .05 + 1 = 1.25, \quad 5 \times 5 \times .05 - 5 \times .05 + 10 = 11,$$

$$\text{then } \frac{1.25}{11} \times 660 \times 2 = 150.$$

(68) There is a house let upon lease  $5\frac{1}{2}$  years to come, I desire to know the yearly rent, when the present worth, at  $4\frac{1}{2}$  per cent. is 291*l.* 6s. 3d.?

*Ans.* £60.

(69) What annuity is that which for 7 years continuance at 6 per cent. produces 1454*l.* 4s. 6d. present worth?

*Ans.* £250.

(70) What annuity is that which for 8 years continuance produces 188*l.* for the present worth at 5 per cent.

*Ans.* £28.

NOTE. When the payments are half-yearly, take half the ratio, twice the number of years, and multiply by 4 p; and when quarterly, take one fourth of the ratio, four times the number of years and multiply by 8 p.



(7<sup>1</sup>) There is an annuity, payable half-yearly for 5 years to come—what is the yearly rent, when the present worth at 5 per cent. is 667*l.* 10*s.*? *Ans.* £150.

(7<sup>2</sup>) There is an annuity, payable quarterly, for 5 years to come—I desire to know the yearly income, when the present worth at 5 per cent. is 671*l.* 5*s.*? *Ans.* £150.

III. When *U*, *P*, *T*, are given to find *R*.

$$\text{RULE. } \frac{tu - p \times t}{2pt + tu - tu} = R.$$

## EXAMPLES.

(7<sup>3</sup>) At what rate per cent. will an annuity of 150*l.* per annum, to continue 5 years, produce the present worth of 660*l.* *Ans.* 5 per cent.

$$150 \times 5 - 660 \times 2 = 180.2 \times 660 \times 5 + 150 \times 5 - 150 \times 5 \times 5 = 3600, \text{ then } 180 \div 3600 = .05 = 5 \text{ per cent.}$$

(7<sup>4</sup>) If a yearly rent of 60*l.* per annum, to continue 5½ years, produce 291*l.* 6*s.* 3*d.* for the present worth, what is the rate per cent.? *Ans.* 4½ per cent.

(7<sup>5</sup>) If an annuity of 250*l.* per annum, to continue 7 years, produce 1454*l.* 4*s.* 6*d.* for the present worth, what is the rate per cent.? *Ans.* 6 per cent.

(7<sup>6</sup>) If a pension of 28*l.* per annum, to continue 8 years, produce 188*l.* for the present worth, what is the rate per cent.? *Ans.* 5 per cent.

NOTE. When the annuities, or rents, &c. are to be paid half-yearly or quarterly, then,

For half-yearly payments take half of the annuity, &c. and twice the number of years, the quotient will be the ratio of half the rate per cent.—and,

For quarterly payments take a fourth part of the annuity, &c. and four times the number of years, the quotient will be the ratio of the fourth part of the rate per cent.

(7<sup>7</sup>) An annuity of 150*l.* per annum, payable half-yearly, having 5 years to come, is sold for 667*l.* 10*s.*—what is the rate per cent.? *Ans.* 5 per cent.

(7<sup>8</sup>) If an annuity of 150*l.* per annum, payable quarterly, having 5 years to come, is sold for 671*l.* 5*s.*—what is the rate per cent.? *Ans.* 5 per cent.

IV. When

IV. When U, P, R, are given to find T.

RULE.  $\frac{2}{r} - \frac{2p}{u} - 1 = x$ , then  $\sqrt{\frac{2p}{ur} + \frac{xx}{4} + \frac{x}{2}} = T$ .

### EXAMPLES.

(79) If an annuity of 150*l.* per annum, produce 66*cl.* for the present worth at 5 per cent. what is the time of its continuance? *Ans.* 5 years.

$$\begin{aligned} \frac{2}{.05} - \frac{660 \times 2}{150} - 1 &= 30.2, & \frac{660 \times 2}{150 \times .05} &= 176 \\ \frac{30.2 \times 30.2}{4} &= 228.01, & \text{then } \sqrt{228.01 + 176} &= 20.1 \\ & & \text{and } 20.1 - \frac{30.2}{2} &= 5 \text{ years.} \end{aligned}$$

(80) For what time may a salary of 60*l.* be purchased for 291*l.* 6*s.* 3*d.* at  $4\frac{1}{2}$  per cent? *Ans.*  $5\frac{1}{2}$  years.

(81) For how long a time may 250*l.* per annum be purchased for 1454*l.* 4*s.* 6*d.* at 6 per cent? *Ans.* 7 years.

(82) What time may a pension of 28*l.* per annum be bought for 188*l.* at 5 per cent? *Ans.* 8 years.

NOTE. When the payments are half yearly, then U will be equal to the half of the annuity, &c. R half the ratio, and T the number of payments; and,

When the payments are quarterly, U will be equal to a fourth part of the annuity, &c. R the fourth of the ratio, and T the number of payments.

(83) If an annuity of 150*l.* per annum, payable half-yearly, is sold for 667*l.* 10*s.* at 5 per cent. I desire to know the number of payments and the time to come?

*Ans.* 10 payments, 5 years.

(84) An annuity of 150*l.* per annum, payable quarterly, is sold for 671*l.* 5*s.* at 5 per cent. What is the number of payments and time to come? *Ans.* 20 payments, 5 years.

### ANNUITIES, &c. taken in REVERSION.

1. To find the present worth of an annuity, &c. taken in Reversion.

RULE. 1. Find the present worth of the yearly sum at the given rate,  $\frac{tr - tr + zt}{2tr + z} \times u = P$ . and for the time of its continuance, thus,

2. Change P into A and find what principal being put to interest will amount to A at the same rate and for the time to come, before the annuity, &c. commences, *thus*,

$$\frac{a}{tr+1} = P.$$

## EXAMPLES.

(<sup>85</sup>) What is the present worth of an annuity of 150*l.* *per annum*, to continue 5 years, but not to commence till the end of 4 years, allowing 5 *per cent.* to the purchaser?

*Ans.* £550.

$$\frac{5 \times 5 \times .05 - 5 \times .05 + 2 \times 5}{5 \times .05 \times 2 + 2} \times 150 = 660, \text{ then } \frac{660}{4 \times .05 + 1} = 550.$$

(<sup>86</sup>) What is the present worth of a lease of 50*l.* *per annum*, for 4 years, but not to commence till the end of 5 years, allowing 4 *per cent.* to the purchaser?

*Ans.* £152 : 5 : 11. 3 *qrs.*

(<sup>87</sup>) A person having the promise of a pension of 20*l.* *per annum*, for 8 years, but not to commence till the end of 4 years, is willing to dispose of the same, at 5 *per cent.* what will be the present worth? *Ans.* £111 : 18 : 1. 14*d.* +

(<sup>88</sup>) A legacy of 40*l.* being left for 6 years to a person of 15 years of age; but not to commence till he is 21; he wanting money, is desirous of selling the same at 4 *per cent.*—what is the present worth? *Ans.* £171 : 14*s.*

2. To find the yearly income of an annuity, &c. in Reversion.

RULE 1. Find the amount of the present worth at the given rate and for the time before the reversion, *thus*,

$$ptr + p = A.$$

2. Change A into P, and find what annuity being fold will produce P, at the same rate, and for the time of its continuance, *thus*,

$$\frac{tr+1}{1tr-tr+2t} \times 2p = U.$$

## EXAMPLES.

(<sup>89</sup>) A person having an annuity left him for 5 years, which does not commence till the end of 4 years, disposed

disposed of it for 550*l.* allowing 5 *per cent.* to the purchaser, what was the yearly income? *Ans.* £150.

$$550 \times 4 \times .05 + 550 = 660, \quad \frac{5 \times .05 + 1}{5 \times 5 \times .05 - 5 \times .05 + 5 \times 2} = 1.13636, \text{ then } 1.13636 \times 660 \times 2 = £150.$$

(<sup>90</sup>) There is a lease of a house taken for 4 years, but not to commence till the end of 5 years, the lessee would sell the same for 152*l.* 6*s.* present payment, allowing 4 *per cent.* to the purchaser—what is the yearly rent?

*Ans.* £50.

(<sup>91</sup>) A person having the promise of a pension for 8 years, which does not commence till the end of 4 years, has disposed of the same for 111*l.* 18*s.* 1*d.* 14*d.* present money, allowing 5 *per cent.* to the purchaser—what was the pension? *Ans.* £20.

(<sup>92</sup>) There is a certain legacy left to a person of 15 years of age, which is to be continued for six years, but not to commence till he arrives at the age of 21; he wanting a sum of money, sells it for 171*l.* 14*s.* allowing 4 *per cent.* to the buyer—what was the annuity left him? *Ans.* £40.

### REBATE OR DISCOUNT.

**S** represents the sum to be discounted.

**P** the present worth.

**T** the time.

**R** the ratio.

**I.** When S, T, R, are given to find P.

**RULE.**  $\frac{S}{tr + 1} = P.$

#### EXAMPLES.

(<sup>1</sup>) What is the present worth of 357*l.* 10*s.* to be paid 9 months hence, at 5 *per cent.* *Ans.* £344 : 11 : 6*d.* 3,168 *qrs.*

$$\frac{357.5}{.75 \times .05 + 1} = 344.5783.$$

(<sup>2</sup>) What is the present worth of 275*l.* 10*s.* due 7 months hence, at 5 *per cent.*? *Ans.* £267 : 13 : 10,164*d.*

(<sup>3</sup>) What is the present worth of 875*l.* 5*s.* 6*d.* due 5 months hence, at 4 *per cent.*? *Ans.* £859 : 3 : 3,2544 *qrs.* +

(<sup>4</sup>) How



(4) How much ready money can I receive for a note of 75*l.* due 15 months hence, at 5 per cent?

*Ans.* £70 : 11 : 9,1752*d.*

II. When P, T, R, are given to find S.

RULE.  $ptr + p = S$ .

EXAMPLES.

(5) If the present worth of a sum of money, due 9 months hence, allowing 5 per cent. be 344*l.* 11*s.* 6*d.* 3,168 *qrs.*—what was the sum first due? *Ans.* £357 : 10*s.*

$$344.5783 \times .75 \times .05 + 344.5783 = £357 : 10*s.*$$

(6) A person owing a certain sum, payable 7 months hence, agrees with the creditor to pay him down 267*l.* 13*s.* 10 164*d.* allowing 5 per cent. for present payment—what is the debt? *Ans.* £275 : 10*s.*

(7) A person receives 859*l.* 3*s.* 3*d.* 3,2544 *qrs.* for a sum of money due 5 months hence allowing the debtor 4½ per cent. for present payment—what was the sum due? *Ans.* £875 : 5 : 6.

(8) A person paid 70*l.* 11*s.* 9,1752*d.* for a debt 15 months hence, he being allowed 5 per cent. for the discount—how much was the debt? *Ans.* £75.

III. S, P, T, are given to find R.

RULE.  $\frac{S-p}{tp} = R$ .

EXAMPLES.

(9) At what rate per cent. will 357*l.* 10*s.* payable 9 months hence, produce 344*l.* 11*s.* 6*d.* 3,168 *qrs.* for present payment? *Ans.* 5 per cent.

$$\frac{357.5 - 344.4783}{344.5783 \times .75} = .05 = 5 \text{ per cent.}$$

(10) At what rate per cent. will 275*l.* 10*s.* payable 7 months hence, produce 267*l.* 13*s.* 10 164*d.* for present payment? *Ans.* 5 per cent.

(11) At what rate per cent. will 875*l.* 5*s.* 6*d.* payable 5 months hence, produce the present payment of 859*l.* 3*s.* 3*d.* 3,2544 *qrs.*? *Ans.* 4½ per cent.

(12) At what rate per cent. will 75*l.* payable 15 months hence produce the present payment of 70*l.* 11*s.* 9,1752*d.*? *Ans.* 5 per cent.

IV. When

IV. When S, P, R, are given to find T.

RULE.  $\frac{s-p}{rp} = T.$

EXAMPLES.

(<sup>13</sup>) The present worth of 357*l.* 10*s.* due for a certain time to come, is 344*l.* 11*s.* 6*d.* 3,168 *qrs.* at 5 per cent.—in what time should the sum have been paid without any rebate?  
*Ans.* 9 months.

$$\frac{357.5 - 344.5783}{344.5783 \times .05} = .75 = 9 \text{ months.}$$

(<sup>14</sup>) The present worth of 275*l.* 10*s.* due for a certain time to come, is, 267*l.* 13*s.* 10,164*d.* at 5 per cent.—in what time should the sum have been paid without any rebate?  
*Ans.* 7 months.

(<sup>15</sup>) A person receives 859*l.* 3*s.* 3*d.* 3,2544 *qrs.* for 875*l.* 5*s.* 6*d.* due at a certain time to come, allowing 4½ per cent. discount—I desire to know in what time the debt should have been discharged without any rebate?  
*Ans.* 5 months.

(<sup>16</sup>) I have received 70*l.* 11*s.* 9,175*d.* for a debt of 75*l.* allowing the person 5 per cent. for prompt payment—I desire to know when the debt would have been payable without the rebate?  
*Ans.* 15 months.

EQUATION of PAYMENTS.

To find the equated time for the payment of a sum of money due at several times.

RULE. Find the present worth of each payment for its respective time thus,  $\frac{s}{1r+1} = P.$

Add all the present worths together; then  $s-p = D.$

$$a.d \frac{d}{pr} = E.$$

EXAMPLES.

(<sup>1</sup>) D owes E 200*l.* whereof 40*l.* is to be paid at 3 months, 60*l.* at 6 months, and 100*l.* at nine months—at what time

time may the whole debt be paid together, rebate being made at 5 per cent. ? *Ans. 6 months 26 days.*

$$\frac{40}{1,0125} = 39,5061 \quad \frac{60}{1,025} = 58,5365 \quad \frac{100}{1,0375} = 96,3855,$$

then  $200 - 39,5061 + 58,5365 + 96,3855 = 5,5719$ , and

$$\frac{5,5719}{194,4231 \times ,05} = ,57315 = 6 \text{ months, } 26 \text{ days.}$$

(<sup>2</sup>) D owes F 800*l.* whereof 200*l.* is to be paid in 3 months, 200*l.* at 4 months, and 400*l.* at 6 months; but they agreeing to make but one payment of the whole at the rate of 5 per cent. rebate—the true equated time is demanded ? *Ans. 4 months, 22 days*

(<sup>3</sup>) E owes F 1200*l.* which is to be paid as follows; 200*l.* down, 500*l.* at the end of 10 months, and the rest at the end of 20 months: but they agreeing to have one payment of the whole, rebate at 3 per cent.—the true equated time is demanded ? *Ans. 1 year, 11 days.*

## COMPOUND INTEREST.

THE letters made use of in Compound Interest are,

A. the amount.

P. the principal.

T. the time.

R. the amount of 1*l.* for a year, at any given rate; which is thus found :

As 100:105::1:1,05. As 100:105,5::1:1,055.

A TABLE of the amount of 1*l.* for one year.

Rates per cent.	Amts. of £1.	Rates per cent.	Am s. of £1.	Rate per cent.	Am s. of £1.
3	1,03	5 <sup>1</sup>	1,035	8	1,03
3 <sup>1</sup> <sub>2</sub>	1,035	6	1,05	8 <sup>1</sup> <sub>2</sub>	1,035
4	1,04	6 <sup>1</sup> <sub>2</sub>	1,055	9	1,09
4 <sup>1</sup> <sub>2</sub>	1,045	7	1,07	9 <sup>1</sup> <sub>2</sub>	1,095
5	1,05	7 <sup>1</sup> <sub>2</sub>	1,075	10	1,1

A TABLE shewing the amount of 1*l.* for any number of years under 31, at 5 and 6 per cent. per annum?

Years.	5 Rates	6	Years.	5 Rates	6.
1	1,05000	1,06000	16	2,18287	2,54035
2	1,10250	1,12360	17	2,29210	2,69277
3	1,15762	1,19101	18	2,40662	2,85434
4	1,21550	1,26247	19	2,52695	3,02560
5	1,27628	1,33822	20	2,65329	3,20713
6	1,34009	1,41852	21	2,78596	3,39956
7	1,40710	1,50363	22	2,92526	3,60353
8	1,47745	1,59384	23	3,07152	3,81975
9	1,55132	1,68948	24	3,22510	4,04893
10	1,62889	1,79084	25	3,38635	4,29187
11	1,71034	1,89829	26	3,55567	4,54938
12	1,79585	2,01219	27	3,73345	4,82234
13	1,88565	2,13292	28	3,92013	5,11168
14	1,97993	2,26090	29	4,11613	5,41838
15	2,07892	2,39655	30	4,32194	5,54349

The above table is thus made: As 100:105::1:1,05 for the first year; then, As 100:105::1,05:1,025, second year, &c.

I. When P, T, R, are given to find A.

RULE.  $p \times r^t = A$ .

#### EXAMPLES.

(1) What will 22*l.* amount to in 3 years time, at 5 per cent. per annum?

$$1,05 \times 1,05 \times 1,05 = 1,157625.$$

then  $1,157625 \times 22 = \text{£}260 : 9 : 3$ . 3 qrs. Ans.

(2) What will 200*l.* amount to in 4 years, at 5 per cent. per annum?

Ans.  $\text{£}243$ , 2,02*l.*

(3) What will 450*l.* amount to in 5 years, at 4 per cent. per annum?

Ans.  $\text{£}547 : 9 : 10$ . 2,0538368 qrs.

(4) What will 500*l.* amount to in 4 years, at  $5\frac{1}{2}$  per cent. per annum?

Ans.  $\text{£}619 : 8 : 2$ . 3,8323 qrs.

II. When A, R, T, are given to find P.

RULE.  $\frac{a}{r^t} = P$ .

#### EXAMPLES.

(5) What principal being put to interest will amount to 260*l.* 9*s.* 3*d.* 3 qrs. in 3 years, at 5 per cent. per annum?



$$1.05 \times 1.05 \times 1.05 = 1.157625 \frac{260,465625}{1.157625} = \text{£}225 \text{ Ans.}$$

(6) What principal being put to interest will amount to 243*l.* 2,025*s.* in 4 years, at 5 per cent. per annum?

*Ans.* £200.

(7) What principal will amount to 547*l.* 9*s.* 10*d.* 2,0538368 *grs.* in 5 years, at 4 per cent. per annum?

*Ans.* £450.

(8) What principal will amount to 619*l.* 8*s.* 2*d.* 3,8323 *grs.* in 4 years, at 5½ per cent?

*Ans.* £500.

III. When P, A, T, are given to find R.

RULE.  $\frac{a}{P} = rt$  } which being extracted by the rule of extraction (the time given to the question shewing the power) will give R.

EXAMPLES.

(9) At what rate per cent. will 225*l.* amount to 260*l.* 9*s.* 3*d.* 3 *grs.* in 3 years?

*Ans.* 5 per cent.

$$\frac{260.465625}{225} = 1.157625, \text{ the cube root of which}$$

(it being the third power)  $1.05 = 5$  per cent.

(10) At what rate per cent. will 200*l.* amount to 243*l.* 2,025*s.* in 4 years?

*Ans.* 5 per cent.

(11) At what rate per cent. will 450*l.* amount to 547*l.* 9*s.* 10*d.* 2,0538368 *grs.* in 5 years?

*Ans.* 4 per cent.

(12) At what rate per cent. will 500*l.* amount to 619*l.* 8*s.* 2*d.* 3,8323 *grs.* in 4 years?

*Ans.* 5½ per cent.

IV. When P, A, R, are given to find T.

RULE.  $\frac{a}{P} = rt$  } which being continually divided by R, till nothing remains, the number of these divisions will be equal to T.

EXAMPLES.

(13) In what time will 225*l.* amount to 260*l.* 9*s.* 3*d.* 3 *grs.* at 5 per cent?

$$\frac{260,465625}{225} = 1.157625 \frac{1.157625}{1.05} = 1.1025 \frac{1.1025}{1.05} = 1.05 \frac{1.05}{1.05} = 1;$$

the number of divisions being three times sought.

(14) In what time will 200*l.* amount to 243*l.* 2,025*s.* at 5 per cent.?

*Ans.* 4 years.

(15) In

(<sup>15</sup>) In what time will 45*l.* amount to 547*l.* 9*s.* 10*d.*  
2,0538368 *qrs.* at 4 per cent? *Ans.* 5 years.

(<sup>16</sup>) In what time will 500*l.* amount to 619*l.* 8*s.* 2*d.*  
3,8323 *qrs.* at 5½ per cent? *Ans.* 4 years.

### ANNUITIES, or PENSIONS in arrears.

☞ *U* represents the annuity, pension, or yearly rent;  
*A*, *R*, *T*, as befo*e.*

A TABLE showing the amount of 1*l.* annuity for any number of years under 31, at 5 and 6 per cent. per annum.

Years.	5	Rates	6	Years.	5	Rates	6.
1	1,00000		1,00000	16	23,65749		25,67252
2	2,05000		2,06000	17	25,84036		28,21288
3	3,15250		3,18360	18	28,13238		30,90565
4	4,31012		4,37461	19	30,53900		33,75999
5	5,52563		5,63709	20	33,06595		36,78559
6	6,80191		6,97532	21	35,71925		39,99272
7	8,14200		8,39383	22	38,50521		43,39229
8	9,54910		9,89746	23	41,43047		46,99582
9	11,02656		11,49131	24	44,50199		50,81557
10	12,57789		13,18079	25	47,72709		54,86451
11	14,20678		14,97164	26	51,11345		59,15638
12	15,91712		16,86994	27	54,66912		63,70576
13	17,71298		18,88213	28	58,40258		68,52811
14	19,59863		21,01506	29	62,32271		73,63979
15	21,57856		23,27597	30	66,43884		79,05818

☞ The above table is made thus: take the first year's amount, which is 1*l.* multiply it by 1,05 + 1 = 2,05 = second year's amount, which also multiply by 1,05 + 1 = 3,1525 = third year's amount.

I. When *U*, *T*, *R*, are given to find *A*.

$$\text{RUL.E. } \frac{ur^t - u}{r - 1} = A, \text{ or by the table thus:}$$

Multiply the amount of 1*l.* for the number of years, and at the rate per cent. given in the question, by the annuity, pension, &c. and it will give the answer.

EXAMPLES.

## EXAMPLES.

(17) What will the annuity of 50*l.* per annum payable yearly, amount to in 4 years at 5 per cent.?

$$1.05 \times 1.05 \times 1.05 \times 1.05 \times 50 = 60,77531250,$$

$$\text{then } \frac{60,7753125 - 50}{1.05 - 1} = \text{£}125 : 10 : 1.2 \text{ qrs. Ans; or,}$$

by the table thus,  $4,31012 \times 50 = \text{£}215 : 10 : 1.1,76 \text{ qrs.}$

(18) What will a pension of 45*l.* per annum, payable yearly, amount to in 5 years, at 5 per cent.?

$$\text{Ans. } \text{£}248 : 13s. 3,27 \text{ qrs.}$$

(19) If a salary of 40*l.* per annum, to be paid yearly, be forborne 6 years, at 5 per cent.—what is the amount?

$$\text{Ans. } \text{£}279. 3,058d.$$

(20) If an annuity of 75*l.* per annum, payable yearly, be omitted to be paid for 10 years, at 6 per cent.—what is the amount?

$$\text{Ans. } \text{£}988 : 11s. 2d. 1,228 \text{ qrs.}$$

II. When A, R, T, are given to find U.

$$\text{RULE. } \frac{ar - a}{r - 1} = U.$$

## EXAMPLES.

(21) What annuity being forborne 4 years, will amount to 215*l.* 10*s.* 1*d.* 2 qrs. at 5 per cent.?

$$\frac{215,50625 \times 1.05 - 215,50625}{1.05 \times 1.05 \times 1.05 \times 1.05 - 1} = \text{£}50. \text{ Ans.}$$

(22) What pension being forborne 5 years, will amount to 248*l.* 13*s.* 3,27 qrs. at 5 per cent.?

$$\text{Ans. } \text{£}45.$$

(23) What salary being omitted to be paid 6 years, will amount to 279*l.* 3,058*d.* at 6 per cent.?

$$\text{Ans. } \text{£}40.$$

(24) If the payment of an annuity, being forborne 10 years, amount to 988*l.* 11*s.* 2*d.* 1,228 qrs. at 6 per cent.—what is the annuity?

$$\text{Ans. } \text{£}75.$$

III. When U, A, R, are given to find T.

$$\text{RULE. } \frac{ar + u - a}{u} = r^t. \quad \left. \begin{array}{l} \text{which being continually divided} \\ \text{by R, till nothing remains, the} \\ \text{number of those divisions will be} \\ \text{equal to T.} \end{array} \right\}$$

O 3

EXAMPLES.

## EXAMPLES.

(<sup>25</sup>) In what time will 50*l.* per annum amount to 215*l.* 10*s.* 1*d.* 2 *qrs.* at 5 per cent. for non-payment?

$$\text{Ans. } \frac{215,50625 \times 1,05 + 50 - 215,50625}{50} = 1,21550625,$$

which being continually divided by R, the number of those divisions will be 4 years.

(<sup>26</sup>) In what time will 45*l.* per annum amount to 248*l.* 13*s.* 3,27 *qrs.* allowing 5 per cent. for forbearance of payment? Ans. 5 years.

(<sup>27</sup>) In what time will 40*l.* per annum amount to 279*l.* 3,058*d.* at 6 per cent.? Ans. 6 years.

(<sup>28</sup>) In what time will 75*l.* per annum amount to 988*l.* 11*s.* 2*d.* 1,228 *qrs.* allowing 6 per cent. for forbearance of payment? Ans. 10 years.

## PRESENT WORTH OF ANNUITIES, PENSIONS, &amp;c.

A TABLE showing the present worth of 1*l.* annuity for any number of years under 31, rebate at 5 and 6 per cent.

Years.	5	Rates	6	Years.	5	Rates	6
1	0,95238		0,94339	16	10,83777		10,10589
2	1,85941		1,83339	17	11,27406		10,47726
3	2,72324		2,67301	18	11,68958		10,82760
4	3,54595		3,46510	19	12,08532		11,15811
5	4,32947		4,21236	20	12,46221		11,46992
6	5,07569		4,91732	21	12,82115		11,76407
7	5,78637		5,58238	22	13,16300		12,04158
8	6,46321		6,20979	23	13,48857		12,30338
9	7,10782		6,80169	24	13,79864		12,55035
10	7,72173		7,36008	25	14,09394		12,78335
11	8,30641		7,88687	26	14,37518		13,00316
12	8,86325		8,38384	27	14,64303		13,21053
13	9,39357		8,85268	28	14,89812		13,40616
14	9,89864		9,29498	29	15,14107		13,59072
15	10,37965		9,71225	30	15,37245		13,76483

The above table is thus made: divide 1*l.* by 1,05 = ,95238, the present worth of the first year, which ÷ 1,05 = ,90703, added to the first year's present worth = 1,85941, the



the second year's present worth; then,  $90703 \div 1.05$  and the quotient added to  $1,85941 = 2,72324$ , third year's present worth, &c.

I. When U, T, R, are given to find P.

$$\text{RULE. } u = \frac{\frac{u}{rt}}{r-1} = P.$$

Or, by the table thus:

Multiply the present worth of 1*l.* annuity for the time and rate *per cent.* given by the annuity, pension, &c. it will give the answer:

#### EXAMPLES.

(<sup>29</sup>) What is the present worth of an annuity of 3*ol.* per annum, to continue 7 years, at 6 *per cent.*?

*Ans.* £167 : 9 : 5, 184*d.*

$$\frac{30}{1.50363} = 19.9517. \quad 30 - 19.9517 = 10.0483. \quad \frac{10.0483}{1.06 - 1} = 167.4716. \quad \text{By the table } 5,58238 \times 30 = 167.4714.$$

(<sup>30</sup>) What is the present worth of a pension of 4*ol.* per annum, to continue 8 years, at five *per cent.*?

*Ans.* £258 : 10 : 6. 1,64 *qrs.*

(<sup>31</sup>) What is the present worth of a salary of 35*l.* to continue 7 years, at 6 *per cent.*? *Ans.* £195 : 7 : 7. 3,968 *qrs.*

(<sup>32</sup>) What is the yearly rent of 5*ol.* to continue 5 years, worth in ready money, at 5 *per cent.*?

*Ans.* £216 : 9 : 5. 2,08 *qrs.*

II. When P, T, R, are given to find U.

$$\text{RULE. } \frac{prt \times r - prt}{rt - 1} = U.$$

#### EXAMPLES.

(<sup>33</sup>) If an annuity be purchased for 167*l.* 9*s.* 5, 184*d.* to be continued 7 years at 6 *per cent.* what is the annuity?

$$\frac{167.4716 \times 1.50363 \times 1.06 - 167.4716 \times 1.50363}{1.50363 - 1} = £30 \text{ An}$$

(<sup>34</sup>) If the present payment of 258*l.* 10*s.* 6*d.* 1,46 *qrs.* be made for a salary 8 years to come, at 5 *per cent.*—what is the salary?  
*Ans.* £40.

(<sup>35</sup>) If the present payment of 195*l.* 7*s.* 7*d.* 3,968 *qrs.* be required for a pension for 7 years to come, at 6 per cent. what is the pension? *Ans.* £35.

(<sup>36</sup>) If the present worth of an annuity, 5 years to come be 216*l.* 9*s.* 5*d.* 2,08 *qrs.* at 5 per cent.—what is that annuity? *Ans.* £50.

III. When U, P, R, are given to find T.

RULE.  $\frac{u}{p+u-r} = r^t$   $\left\{ \begin{array}{l} \text{which being continually divided by} \\ R, \text{ till nothing remains, the number} \\ \text{of those divisions will be equal to } T. \end{array} \right.$

(<sup>37</sup>) How long may a lease of 30*l.* yearly rent be had for 167*l.* 9*s.* 5*d.* 184 *qrs.* allowing 4 per cent. to the purchaser?

$$\frac{30}{167,4716 + 30 - 177,5198} = 1,50363 \quad \left\{ \begin{array}{l} \text{which being con-} \\ \text{tinually divided,} \\ \text{the number of those} \\ \text{divisions will be} \\ \text{= to } T = 7 \text{ years.} \end{array} \right.$$

(<sup>38</sup>) If 258*l.* 10*s.* 6*d.* 1,46 *qrs.* is paid down for a lease of 40*l.* per annum at 5 per cent.—how long is the lease purchased for? *Ans.* 8 years.

(<sup>39</sup>) If a house is let upon lease for 35*l.* per annum, and the lessee makes present payment of 195*l.* 7*s.* 8*d.* he being allowed 6 per cent.—I demand how long the lease is purchased for? *Ans.* 7 years.

(<sup>40</sup>) For what time may a lease of 50*l.* per annum be purchased, when present payment is made of 216*l.* 9*s.* 5*d.* 2,08 *qrs.* at 5 per cent? *Ans.* 5 years.

## ANNUITIES, LEASES, &c. taken in REVERSION.

1. To find the present worth of Annuities, Leases, &c. taken in Reversion.

RULE 1. Find the present worth of the annuity, &c. at the given rate, and for the time of its continuance, thus,

2. Change P into A and find what principal being put to interest will amount to P at the same rate, and for the time to come, before the annuity commences, which will be the present worth of the annuity, &c. thus.

$$\frac{u}{r^t} = P$$

$$\frac{a}{r^t} = P.$$

## EXAMPLES.

(<sup>41</sup>) What is the present worth of a reversion of a lease of 40*l. per annum*, to continue for 6 years, but not to commence till the end of 2 years, allowing 6 *per cent.* to the purchaser?

*Ans.* £175 : 1 : 1 : 2,048 *qrs.*

$$\frac{40}{1,41852} = 28,1984 \quad \frac{40 - 28,1984}{1,06 - 1} = 196,6933 \quad \frac{196,6933}{1,1236} = 175,0563.$$

(<sup>42</sup>) What is the present worth of a reversion of a lease of 60*l. per annum*, to continue for 7 years, but not to commence till the end of 3 years, allowing 5 *per cent.* to the purchaser?

*Ans.* £299 : 18 : 2. 3,4 *qrs.*

(<sup>43</sup>) There is a lease of a house at 30*l. per annum*, which is yet in being for 4 years, and the lessee is desirous to take a lease in reversion for 7 years, to begin when the old lease shall be expired—what will be the present worth of the said lease in reversion, allowing 5 *per cent.* to the purchaser?

*Ans.* £142 : 16 : 3. 2,688 *qrs.*

1. To find the yearly income of an annuity, &c. taken in Reversion.

RULE 1. Find the amount of the present worth, at the given rate, and for the time before the annuity commences, *thus*,  $prt = A$ .

2. Change A into P, and find what yearly rent being sold will produce P, at the same rate, and for the time of its continuance, which will be the yearly sum  $\frac{prt \times a - prt}{rt - 1} = U$ . required.

## EXAMPLES.

(<sup>44</sup>) What annuity to be entered upon two years hence, and then to continue 6 years, may be purchased for 175*l.* 1*s.* 1*d.* 2,048 *qrs.* at 6 *per cent.*

$$175,0563 \times 1,1236 = 196,6933, \text{ then } \frac{196,6933 \times 1,41852 \times 1,06 - 279,01337}{1,41852 - 1} = £40 \text{ Ans.}$$

(<sup>45</sup>) The present worth of the lease of a house is 299*l.* 18*s.* 2*d.* 3,4 *qrs.* taken in reversion for 7 years, but not to commence till the end of 3 years, allowing 5 *per cent.* to the purchaser—what is the yearly rent? *Ans.* £60.

(46) There is a lease of a house in being for 4 years, and the lessee being minded to take a lease in reversion for 7 years, to begin when the old lease shall be expired, paid down 142*l.* 16*s.* 3*d.* 2,688 *qrs.*—what was the yearly rent of the house, when the lessee was allowed 5 *per cent.* for present payment? *Ans.* £30.

*Purchasing FREEHOLD or REAL ESTATES, is such as are bought to continue for ever.*

I. When U, R are given to find W.

$$\text{RULE. } \frac{u}{r-1} = W.$$

EXAMPLES.

(47) What is the worth of a freehold estate of 5*ol.* *per annum*, allowing 5 *per cent.* to the buyer?

$$\text{Ans. } \frac{50}{1,05-1} = £1000.$$

(48) What is an estate of 14*ol.* *per annum*, to continue for ever, worth in present money, allowing 4 *per cent.* to the buyer? *Ans.* £3500.

(49) If a freehold estate of 75*l.* yearly rent was to be sold, what is the worth, allowing the buyer 6 *per cent.*? *Ans.* £1250.

II. When W, R are given to find U.

$$\text{RULE. } w \times r - 1 = U.$$

EXAMPLES.

(50) If a freehold estate is bought for 1000*l.* and the allowance of 5 *per cent.* is made to the buyer—what is the yearly rent?  $1,05 - 1 = ,05$ , then  $1000 \times ,05 = £50$ . *Ans.*

(51) If an estate be sold for 3500*l.* and 4 *per cent.* allowed to the buyer—what is the yearly rent? *Ans.* £140.

(52) If a freehold estate is bought for 1250*l.* present money, and an allowance of 6 *per cent.* made to the buyer for the same—what is the yearly rent? *Ans.* £75.

III. When W, U, are given to find R.

$$\text{RULE. } \frac{w+u}{w} = R.$$

EXAMPLES.



## EXAMPLES.

(<sup>53</sup>) If an estate of 50*l. per annum* be bought for 1000*l.*, what is the rate *per cent.*?

$$\text{Ans. } \frac{1000 + 50}{1000} = 1,05 = \text{per cent.}$$

(<sup>54</sup>) If a freehold estate of 140*l. per annum* be bought for 3500*l.*—what is the rate *per cent.* allowed? *Ans.* 4 *per cent.*

(<sup>55</sup>) If an estate of 75*l. per annum* is sold for 1250*l.*—what is the rate *per cent.* allowed? *Ans.* 6 *per cent.*

## Purchasing FREEHOLD ESTATES in REVERSION.

2. To find the worth of a freehold estate in reversion.

RULE 1. Find the worth of the yearly rent, *thus*,  $\frac{u}{r-1} = W$ .

2. Change W into A, and find what principal being put to interest, will amount to A at the same rate, and for the time to come, before the estate commences, and that will be the worth of the estate in reversion :

$$\text{thus, } \frac{a}{rt} = P.$$

## EXAMPLES.

(<sup>56</sup>) If a freehold estate of 50*l. per annum*, to commence 4 years hence, is to be sold—what is it worth, allowing the purchaser 5 *per cent.* for present payment?

$$\frac{50}{1,05-1} = 1000, \text{ then, } \frac{1000}{1,2155} = \text{£}822 : 14 : 1 : 2 \text{ qrs. } + \text{Ans.}$$

(<sup>57</sup>) What is an estate of 200*l.* to continue for ever, but not to commence till the end of 2 years, worth in ready money, allowing the purchaser 4 *per cent.*? *Ans.* £4622 : 15 : 7 : 44*d.*

(<sup>58</sup>) What is an estate of 240*l. per ann.* worth in ready money, to continue for ever, but not to commence till the end of three years, allowance being made at 6 *per cent.*?

$$\text{Ans. } \text{£}3358 : 9 : 10 : 2,24 \text{ qrs.}$$

2. find the yearly rent of an estate taken in reversion.

RULE 1. Find the amount of the worth of the estate, at the given rate and time before it commences,

$$\text{thus, } wrt = A.$$

2. Change A into W, and find what yearly rent being sold will produce U, at the same rate; which will be the yearly rent required,

$$\text{thus, } \frac{wr \times r - wr.}{r} = U.$$

## EXAMPLES.

(<sup>59</sup>) If a freehold estate, to commence 4 years hence, is sold for 822*l.* 14*s.* 1*d.* 2*qrs.* allowing the purchaser 5 *per cent.*—what is the yearly income?

$$822,07625 \times 1,2155 = 1000.$$

$$\text{then } \frac{1000 \times 1,05 \times 1,05 - 1050}{1,05} = \text{£}50, \text{ Ans.}$$

(<sup>60</sup>) A freehold estate is bought for 4622*l.* 15*s.* 7,44*d.* which does not commence till the end of 2 years, the buyer being allowed 4 *per cent.* for his money—I desire to know the yearly income? *Ans.* £200.

(<sup>61</sup>) There is a freehold estate sold for 3358*l.* 9*s.* 10*d.* 2,24*qrs.* but not to commence till the expiration of 3 years, allowing 6 *per cent.* for present payment—what is the yearly income? *Ans.* £240.

## REBATE OR DISCOUNT.

A TABLE showing the present worth of 1*l.* due any number of years, to commence under 31, rebate at 5 and 6 *per cent.*

Years.	5	Rates.	6	Years.	5	Rates	6
1	,952381		,943396	16	,458111		,393647
2	,907030		,889996	17	,436296		,371364
3	,863838		,839619	18	,415520		,350343
4	,822702		,792093	19	,395734		,330513
5	,783526		,747258	20	,376889		,311804
6	,746215		,704960	21	,358942		,294155
7	,710682		,665057	22	,341849		,277505
8	,676839		,627412	23	,325571		,261797
9	,644609		,591898	24	,310067		,246978
10	,613913		,558394	25	,295302		,232998
11	,584679		,526787	26	,281240		,219810
12	,556837		,496969	27	,267848		,207368
13	,530321		,468839	28	,255093		,195530
14	,505068		,442301	29	,242946		,184556
15	,481017		,417265	30	,231377		,174110

☞ The above Table is thus made:  $1 \div 1,05 = ,952381$ , first year's present worth;  $,952381 \div 1,05 = ,90703$ , second year; and  $,90703 \div 1,05 = ,863838$ , third year, &c.

I. When S, T, R, are given to find P.

$$\text{RULE. } \frac{S}{r^t} = P.$$

EXAMPLES.

(<sup>1</sup>) What is the present worth of 315*l.* 12*s.* 4*d.* payable 4 years hence at 6 per cent.?

$$1,06 \times 1,06 \times 1,06 \times 1,06 = 1,26247: \text{ then}$$

By the Table.

$$\frac{315,6175}{1,26247} = \text{£}250 \text{ Ans.}$$

$$\begin{array}{r} 315,6175 \\ ,79203 \end{array}$$

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$$249,9984124275$$


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(<sup>2</sup>) If 344*l.* 14*s.* 9*d.* 1,92 *qrs.* be payable in 7 years time, what is the present worth, rebate being made at 5 per cent.?

Ans. £245.

(<sup>3</sup>) There is a debt of 441*l.* 17*s.* 3*d.* 1,92 *qrs.* which is payable 4 years hence, but it is agreed to be paid in present money—what sum must the creditor receive, rebate being made at 6 per cent.?

Ans. £350

II. When P, R, T are given to find S.

RULE.  $p \times rt = S.$

EXAMPLES.

(<sup>4</sup>) If a sum of money, due 4 year hence, produce 250*l.* for the present payment, rebate being made at 6 per cent.—what was the sum first due?

$$250 \times 1,26247 = \text{£}315 : 12 : 4,2d. \text{ Ans.}$$

(<sup>5</sup>) If 245*l.* be received for a debt payable 7 years hence, and an allowance of 5 per cent. to the debtor for present payment—what was the debt? Ans. £344: 14: 9. 1,92 *qrs.*

(<sup>6</sup>) There is a sum of money due at the expiration of 4 years, but the creditor agrees to take 350*l.* for present payment, allowing 6 per cent.—what was the debt?

$$\text{Ans. £}441 : 17 : 3. 1,92 \text{ qrs.}$$

III. When S, P, R are given to find T.

RULE.  $\frac{S}{P} = rt$  { which being continually divided by R, till nothing remains, the number of those divisions will be equal to T.

P

EXAMPLES.

## EXAMPLES.

(7) The present payment of 250*l.* is made for a debt of 315*l.* 12*s.* 4,2*d.* rebate at 6 *per cent.*—in what time was the debt payable?

$$\text{Ans. } \frac{315,6175}{250} = 1,26247 \quad \left\{ \begin{array}{l} \text{which being continually divided,} \\ \text{these divisions will be equal to 4} \\ \text{= the number of years.} \end{array} \right.$$

(8) A person receives 245*l.* now, for a debt of 344*l.* 14*s.* 9*d.* 1,92 *qrs.* rebate being made at 5 *per cent.*—I demand in what time the debt was payable? *Ans.* 7 years.

(9) There is a debt of 441*l.* 17*s.* 3*d.* 1,92 *qrs.* due at a certain time to come, but 6 *per cent.* being allowed to the debtor for the present payment of 350*l.*—I desire to know in what time the sum should have been made without any rebate? *Ans.* 4 years.

IV. When S, P, T are given to find R.

$$\text{RULE. } \frac{S}{P} = r^T \quad \left\{ \begin{array}{l} \text{which being extracted by the rules of ex-} \\ \text{traction (the time given in the question} \\ \text{showing the power) will be equal to R.} \end{array} \right.$$

## EXAMPLES.

(10) A debt of 315*l.* 12*s.* 4,2*d.* is due 4 years hence, but it is agreed to take 250*l.* now—what is the rate *per cent.* that the rebate is made at?

$$\frac{315,6175}{250} = 1,26247; \sqrt[4]{1,26247} = 1,06 = 6 \text{ per cent. } \text{Ans.}$$

(11) The present worth of 344*l.* 14*s.* 9*d.* 1,92 *qrs.* payable 7 years hence, is 245*l.*—at what rate *per cent.* is rebate made? *Ans.* 5 *per cent.*

(12) There is a debt of 441*l.* 17*s.* 3*d.* 1,92 *qrs.* payable in 4 years time, but it is agreed to take 350*l.* present payment—I desire to know at what rate *per cent.* rebate is made at? *Ans.* 6 *per cent.*

PART



## PART IV.

## DUODECIMALS ;

Or, what is generally called

*Gross Multiplication, and Squaring of Dimensions by ARTIFICERS and WORKMEN.*

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RULE for MULTIPLYING DUODECIMALLY.

1. **U**NDER the multiplicand write the corresponding denominations of the multiplier.

2. Multiply each term in the multiplicand (beginning at the lowest) by the feet in the multiplier; write each result under its respective term, observing to carry an unit for every 12, from each lower denomination to its next superior.

3. In the same manner multiply the multiplicand by the primes in the multiplier, and write the result of each term one place more to the right-hand of those in the multiplicand.

4. Work in the same manner with the seconds in the multiplier, setting the result of each term two places to the right-hand of those in the multiplicand, and so on for thirds, fourths, &c.

## EXAMPLES.

*ft. in. ft. in.*

(<sup>1</sup>) Multiply 7 : 9 by 3 : 6.

<i>Gross Multiplication.</i>	<i>Practice.</i>	<i>Duodecimals.</i>	<i>Decimals.</i>
$\begin{array}{r} 7 \times 9 \\ 3 \times 6 \\ \hline \end{array}$	$\begin{array}{r} 6\frac{1}{2} 7 : 9 \\ 3 : 6 \\ \hline \end{array}$	$\begin{array}{r} 7 : 9 \\ 3 : 6 \\ \hline \end{array}$	$\begin{array}{r} 7.75 \\ 3.5 \\ \hline \end{array}$
$\begin{array}{r} 21 : 0 : 0 = 7 \times 3 \\ 2 : 3 : 0 = 9 \times 3 \\ 3 : 6 : 0 = 7 \times 6 \\ 0 : 4 : 6 = 9 \times 6 \\ \hline \end{array}$	$\begin{array}{r} 23 : 3 \\ 3 : 10 : 6 \\ \hline 27 : 1 : 6 \\ \hline \end{array}$	$\begin{array}{r} 23 : 3 \times 3 \\ 3 : 10 : 6 \times 6 \\ \hline 27 : 1 : 6 \\ \hline \end{array}$	$\begin{array}{r} 3.875 \\ 23.25 \\ \hline 27.125 \\ \hline \end{array}$
$\underline{\underline{27 : 1 : 6}}$	P 2		( <sup>1</sup> ) Mult.

	<i>f. in. p.</i>	<i>f. in. p.</i>	<i>f. in. parts.</i>
(2) Mult.	8:5	by 4:7	<i>Facit</i> 38:6:11
(3) Mult.	9:8	by 7:6	<i>F.</i> 72:6:0
(4) Mult.	8:1	by 3:5	<i>F.</i> 27:7:5
(5) Mult.	7:6	by 5:9	<i>F.</i> 43:1:6
(6) Mult.	4:7	by 3:10	<i>F.</i> 17:6:10
(7) Mult.	7:5:9	by 3:5:3	<i>F.</i> 25:8:6:2:3
(8) Mult.	10:4:5	by 7:8:6	<i>F.</i> 79:11:0:6:6
(9) Mult.	75:7	by 9:8	<i>F.</i> 730:7:8
(10) Mult.	97:8	by 8:9	<i>F.</i> 854:7:0
(11) Mult.	57:9	by 9:5	<i>F.</i> 543:9:9
(12) Mult.	75:9	by 17:7	<i>F.</i> 1331:11:3
(13) Mult.	87:5	by 35:8	<i>F.</i> 3117:10:4
(14) Mult.	179:3	by 38:10	<i>F.</i> 6960:10:6
(15) Mult.	259:2	by 48:11	<i>F.</i> 12677:6:10
(16) Mult.	257:9	by 39:11	<i>F.</i> 10288:6:3
(17) Mult.	311:4:7	by 36:7:5	<i>F.</i> 11402:2:4:11:11.
(18) Mult.	321:7:3	by 9:3:6	<i>F.</i> 2988:2:10:4:6.

### The APPLICATION.

Artificers' work is computed by different measures, viz.

1. Glazing and mason's flat work by the foot.
2. Painting, plaistering, paving, &c. by the yard.
3. Partitioning, flooring, roofing, tiling, &c. by the square of 100 feet.
4. Brickwork, &c. by the rod or  $16\frac{1}{2}$  feet, whose square is  $272\frac{1}{4}$ .

### 1. MEASURING *by the FOOT SQUARE, as GLAZIERS' and MASON'S flat work.*

#### EXAMPLES.

(19) There is a house with three tier of windows, 3 in a tier, the height of the first tier is 7 feet 10 inches, the second is 6 feet 8 inches, and the third 5 feet 4 inches, the breadth of each is 3 feet 11 inches—what will the glazing come to at 1*d.* per foot?

*Duodecimals.*


Duodecimals.	feet.	in.	pts.
7 : 10 the	233 :	0 :	6 at 14d. per foot.
6 : 8 heights			
5 : 4 added	2d. $\frac{1}{8}$ 233		= 1s.
	38 :	10	= 2d.
19 : 10			$\frac{1}{2}$ = 6 parts,
3 = windows			
	210)271	1 : 10 $\frac{1}{2}$	
59 : 6 in a tier			
3 : 11 in a breadth	Ans. £	13 : 11 : 10 $\frac{1}{2}$	
178 : 6			
54 : 6 : 6			
233 : 0 : 6			

(<sup>20</sup>) What is the worth of 8 squares of glass, each measuring 4 feet 10 inches long, and 2 feet 11 inches broad, at 4 $\frac{1}{8}$ d. per foot? *Ans. £2 : 2 : 3 $\frac{1}{4}$ . +*

(<sup>21</sup>) There are 8 windows to be glazed, each measures 1 foot 6 inches wide, and 3 feet in height—how much will they come to at 7 $\frac{1}{4}$ d. per foot? *Ans. £1 : 3 : 3.*

(<sup>22</sup>) What is the price of a marble slab, whose length is 5 feet 7 inches, and the breadth 1 foot 10 inches, at 6s. per foot? *Ans. £3 : 1 : 5.*

## 2. MEASURING by the YARD SQUARE, as PAVIERS, PAINTERS, PLAISTERERS, and JOINERS.

 Divide the square feet by 9, and it will give the number of square yards.

### EXAMPLES.

(<sup>23</sup>) A room is to be ceiled, whose length is 74 feet 9 inches, and width 11 feet 6 inches—what will it come to at 3s. 10 $\frac{1}{2}$ d. per yard? *Ans. £18 : 10 : 1 $\frac{1}{4}$ . +*

(<sup>24</sup>) What will the paving of a court-yard come to at 4 $\frac{3}{4}$ d. per yard, the length being 58 feet 6 inches, and breadth 54 feet 9 inches? *Ans. £7 : 0 : 10 $\frac{1}{4}$ . +*

(<sup>25</sup>) A room painted 97 feet 8 inches about, and 9 feet 10 inches high—what does it come to at 2s. 8 $\frac{1}{4}$ d. per yard? *Ans. £14 : 11 : 2 $\frac{1}{2}$ . +*

(<sup>26</sup>) What is the content of a piece of wainscoting in yards square, that is 8 feet 3 inches long, and 6 feet 6 inches broad, and what will it come to at 6s. 7 $\frac{1}{2}$ d. per yard? *Ans. £1 : 19 : 5 $\frac{1}{2}$ . +*

(<sup>27</sup>) What will the paving of a court-yard come to at 3s. 2d. per yard, if the length be 27 feet 10 inches, and the breadth 14 feet 9 inches? *Ans.* £7 4 5½ +

(<sup>28</sup>) A person has paved a court-yard 42 feet 9 inches in front, and 68 feet 6 inches in depth, and in this he laid a footway the depth of the court, of 5 feet 6 inches in breadth: the footway is laid with Purbeck-stone, at 3s. 6d. per yard, and the rest with pebbles, at 3s. per yard—what will the whole come to? *Ans.* £49 17 0½.

(<sup>29</sup>) What will the plaistering of a ceiling, at 10d. per yard come to, supposing the length at 21 feet 8 inches, and the breadth 14 feet 10 inches? *Ans.* £1 9 9.

(<sup>30</sup>) What will the wainscoting of a room come to at 6s. per square yard, supposing the height of the room (taking in the cornice and moulding) be 12 feet 6 inches, and the compass 83 feet 8 inches, the three window-shutters, each 7 feet 8 inches, by 3 feet 6 inches; and the door 7 feet by 3 feet 6 inches; the shutters and door being worked on both sides is reckoned work and half work? *Ans.* £36 12 2½.

### 3. MEASURING the SQUARE of 100 feet, as FLOORING, PARTITIONING, ROOFING, TILING, &c.

#### EXAMPLES.

(<sup>31</sup>) In 173 feet 10 inches in length, and 10 feet 7 inches in height of partitioning—how many squares? *Ans.* 18 squares, 39 feet, 8 inches, 10 parts,

(<sup>32</sup>) If a house of 3 stories, besides the ground-floor, was to be floored at 6l. 10s. per square, and the house measured 20 feet 8 inches, by 16 feet 9 inches. There are 7 fire places, whose measures are two of 6 feet, by 4 feet 6 inches each, two of 6 feet, by 5 feet 4 inches each, and two of 5 feet 8 inches, by 4 feet 8 inches, and the seventh of 5 feet 2 inches, by 4 feet, and the well-hole of the stairs is 10 feet 6 inches, by 8 feet 9 inches—what will the whole come to? *Ans.* £53 13 3½ +

(<sup>33</sup>) If a house measures within the walls 52 feet 8 inches in length, and 30 feet 6 inches in breadth, and the roof be of a true pitch—what will it come to roofing at 10s. 6d. per square? *Ans.* £12 12 11¾ +

NOTE. In tiling, roofing, and slating, it is customary to reckon 10s. flat and half of any building within the walls, to be



be the measure of the roof of that building, when the said roof is of a true pitch, i. e. when the rafters are  $\frac{3}{4}$  of the breadth of the building; but if the roof is more or less than the true pitch, they measure from one side to the other with a rod or string.

(<sup>34</sup>) What will the tiling of a barn cost, at 25s. 6d. per square, the length being 43 feet 10 inches, and breadth 27 feet 5 inches on the flat, the eave-boards projecting 16 inches on each side?  
*Ans.* £24: 9: 5 $\frac{1}{4}$ +

#### 4. MEASURING by the ROD.

NOTE. Bricklayers always value their work at the rate of a brick and a half thick; and if the thickness of the wall be more or less, it must be reduced to that thickness by this rule.

RULE. Multiply the area of the wall by the number of half bricks the thickness the wall is of; the product divided by 3, gives the area.

#### EXAMPLES.

(<sup>35</sup>) If the area of the wall be 4085 feet, and the thickness two bricks and a half—how many rods doth it contain?  
*Ans.* 25 + rods.

(<sup>36</sup>) If a garden wall be 254 feet round, and 12 feet 7 inches high, and 3 bricks thick—how many rods doth it contain?  
*Ans.* 23 rods, 130 feet, 6 in. 11.52 p.

(<sup>37</sup>) How many square rods are there in a wall 62 $\frac{1}{2}$  feet long, 14 feet 8 inches high, and 2 $\frac{1}{2}$  bricks thick?  
*Ans.* 5 rods, 167 feet, 5 + in.

(<sup>38</sup>) If the side walls of a house be 28 feet 10 inches in length, and the height of the roof from the ground 53 feet 8 inches, and the gable, or triangular part at the top, to rise 42 course of bricks, reckoning 4 course to a foot. Now 20 feet high is 2 $\frac{1}{2}$  bricks thick, 20 feet more at 2 bricks thick, 15 feet 8 inches more, at  $\frac{1}{2}$  brick thick, and the gable at 1 brick thick—what will the whole work come to at 5l. 16s. per rod?  
*Ans.* £48: 12: 7.

#### 5. Multiplying several figures by several, and the product to be produced in one line only.

RULE. Multiply the units of the Multiplicand by the units of the multiplier, setting down the units of the product,

duct, and carry the tens; next multiply the tens in the multiplicand by the units of the multiplier, to which add the product of the units of the multiplicand, multiplied by the tens in the multiplier, and the tens carried; then multiply the hundreds in the multiplicand by the units of the multiplier, adding the product of the tens in the multiplicand multiplied by the tens in the multiplier, and the units of the multiplicand by the hundreds in the multiplier: and so proceed till you have multiplied the multiplicand all through by every figure in the multiplier.

## EXAMPLE.

Multiply 35234  
by 52424.

1847107216

35234  
52424

140936

70468

140936

70468

176170

1847107216

## EXPLANATION.

*First*,  $4 \times 4 = 16$ , that is, 6 and carry 1. *Secondly*,  $3 \times 4 + 4 \times 2$ , and 1 that is carried is 21; set down 1 and carry 2. *Thirdly*,  $2 \times 4 + 3 \times 2 + 4 \times 4 + 2$  carried = 32; that is 2 and carry 3. *Fourthly*,  $5 \times 4 + 2 \times 2 + 3 \times 4 + 4 \times 2 + 3$  carried = 47; set down 7, and carry 4. *Fifthly*,  $3 \times 4 + 5 \times 2 + 2 \times 4 + 3 \times 2 + 4 \times 5 + 4$  carried = 60; set down 0 and carry 6. *Sixthly*,  $3 \times 2 + 5 \times 4 + 2 \times 2 + 3 \times 5 + 6$  carried = 51; set down 1, and carry 5. *Seventhly*,  $3 \times 4 + 5 \times 2 + 2 \times 5 + 5$  carried = 37; that is 7, and carry 3. *Eighthly*,  $3 \times 2 + 5 \times 5 + 3$  carried = 34; set down 4, and carry 3. *Lastly*,  $3 \times 5 + 3$  carried = 18; which being multiplied by the last figure in the multiplier, set the whole down, and the work is finished.

## PART V.

## THE MENSURATION OF CIRCLES, &amp;c.

**A** CIRCLE is a plain figure, contained under one line which is called a circumference, unto which all lines drawn from a point in the middle of the figure, called the centre, and falling upon the circumference, are equal the one to the other. The circle contains more space than any plain figure of equal compass.

The proportion of the diameter of a circle to the circumference was never yet exactly found, notwithstanding many eminent and learned men have laboured very far therein; among whom the learned Van Culen has hitherto outdone all, in his having calculated the said proportion to thirty-six places of decimals, which are engraved upon his tomb-stone, in St. Peter's church, in Leyden.

Let it be required to find the area of a circle, whose diameter is an unit. By the proportion of Van Culen, if the diameter be 1, the circumference will be 3,14159265, &c. of which 3,1416 is sufficient in most cases. Then the rule teaches, to multiply half the circumference by half the diameter, and the product is the area; that is, multiply 1,5708 by .5, (*viz.* half 3,1416 by half 1) and the product is ,7854, which is the area of the circle whose diameter is 1.

Again, if the area be required when the circumference is 1, first find what the diameter will be, thus, as 3,1416 : 1 :: 1 : ,318309, which is the diameter when the circumference is 1. Then multiply half ,318309 by half 1, that is ,159154 by .5, and the product is ,079577; which is the area of a circle whose circumference is 1.

If the area be given to find the side of the square equal, you need but extract the square root of the area given, and it is done. So that the square root of ,7854 is ,8862, which is the side of a square equal when the diameter is 1. And if you extract the square root of ,079577, it will be ,2821, which is the side of the square equal to the circle whose circumference is 1.

If the side of a square within a circle be required, if you square the semi-diameter, and double that square, and out of that sum extract the square root, that shall be the side of the square, which may be inscribed in that circle: so if the

diameter of the circle be 1, then the half is ,5, which squared is ,25, and this doubled is ,5, whose square root is ,7071, the side of the square inscribed.

From what has been here said, the ingenious scholar will easily perceive how all other proportional numbers are found, and may examine them at leisure. We shall now proceed to the different problems.

*Problem 1.* Having the diameter and the circumference to find the area.

Every circle is equal to a parallelogram, whose length is equal to half the circumference, and the breadth equal to half the diameter; therefore multiply half the circumference by half the the diameter, and the product is the area of the circle.

Thus, if the diameter of a circle, that is, the line drawn across the circle through the centre, be 22,6; and if the circumference be 71, the half of 71 is 35,5, and the half of 22,6 is 11,3, which multiplied together the product is 401,15, which is the area of the circle.

*Problem 2.* Having the diameter of a circle, to find the circumference.

As 7:22, so is the diameter to the circumference. Or, as 113:355, so is the diameter to the circumference. Or, as 1:3,141593, so is the diameter, to the circumference.

Let the diameter, as in the first problem, be 22,6. This multiplied by 22, and the product divided by 7, gives 71,028 for the circumference; but the two other proportions are more exact, as appears by the following work.

$  \begin{array}{r}  3,141593 \\  \underline{22,6} \\  18849558 \\  6283186 \\  6283186 \\  \hline  71,0000018  \end{array}  $	$  \begin{array}{r}  355 \\  \underline{22,6} \\  2130 \\  710 \\  710 \\  \hline  113)8023,0(71 \\  \underline{113} \\  \dots  \end{array}  $
--	--

*Problem 3.* Having the circumference of a circle, to find the diameter.

As 1 is to ,318309, so is the circumference to the diameter. Or, as 355:113, so is the circumference to the diameter. Or, as 22:7, so is the circumference to the diameter.



Let the circumference be 71, and then proceed with either of the above three proportions, as follow :

318309	113	71
71	71	7
318309	113	22)497(22.56
2228163	791	57
		130
22,599939	355)8023)22,6	200
	923	2
	2130	
	...	

Thus, by the second proportion, the diameter is 22,6 ; but by the other two it falls something short.

*Problem 4.* Having the diameter of a circle to find the area.

All circles are in proportion one to another, as are the squares of the diameters, (by Euclid. 12. ii.) Now the area of a circle, whose diameter is 1, will be ,785398, according to Van Culen's proportion before-mentioned ; but for practice ,7854 will be sufficient. Therefore, as 1 (the square of the diameter 1) is to ,7854, so is 510,76 (the square of 22,6, the diameter of the given circle) to 401,15, the area of the given circle.

*Problem 5.* Having the circumference of a circle to find the area.

Because the diameters of circles are proportioned to their circumferences ; that is, as the diameter of one circle is to its circumference : so is the diameter of another circle to its circumference : therefore the areas of circles are to one another, as the squares of the circumferences. And if the circumference of a circle be 1, the area of that circle will be ,07958 ; then the square of 1 is 1, and the square of 71 (the circumference of the former circle) is 5041. Therefore it will be, as 1 : ,07958 :: 5041 : 401,16278.

*Problem 6.* By having the diameter, to find the side of a square that is equal in area to that circle.

If the diameter of a circle be 1, the side of a square equal thereunto will be ,8862. Therefore, as 12 : ,8862 :: 22,6 (the diameter) : 20,02812, the side of the square.

*Problem 7.* By having the circumference, to find the side of the square equal.

If the circumference of a circle be 1, the side of the square equal will be ,2821. Therefore, as 1 : ,2821 :: 71 (the circumference) : 20,0291, the side of the square.

*Problem 8.* Having the diameter, to find the side of a square, which may be inscribed in that circle.

If the diameter of a circle be 1, the side of the square inscribed will be .7071. Therefore, as 1::7071::22,6:15,98046, the side inscribed. Or if you square the semi-diameter, and double that square, the square root of the double square will be the side of the square inscribed.

*Problem 9.* Having the circumference, to find the side of a square which may be inscribed.

If the circumference be 1, the side of a square inscribed will be .2251. Therefore, as 1::2251::71:15,9821, the side of the square.

*Problem 10.* Having the area to find the diameter.

If the area of a circle be 1, the square of the diameter is 1,2732. Therefore, as 1:1,2732::401,15:510,744180, the square root of which is 22,599, the diameter.

*Problem 11.* Having the area to find the circumference.

If the area of a circle be 1, the square of the circumference will be 12,56637. Therefore, as 1:12,56637::401,15:5040,99932550, the square root of which is 70,9999.

*Problem 12.* Having the area, to find the side of a square inscribed.

If the area of a circle be 1, the area of a square inscribed within that circle will be .6366. Therefore, as 1:401,15::6366:255,372090, the root of which is 15,980, the side of the square sought.

*Problem 13.* Having the side of a square, to find the diameter of the circumscribing circle.

If the side of a square be 1, the diameter of a circle that will circumscribe that square, will be 1,4142. Therefore, as 1:1,4142::15,98:22,598916, the diameter sought.

*Problem 14.* Having the side of a square, to find the diameter of a circle equal to it.

If the side of a square be 1, the diameter of a circle equal to it will be 1,128. Therefore, as 1:1,128::20,0291:22,5928248, the diameter required.

*Problem 15.* Having the side of a square, to find the circumference of a circumscribing circle.

If the side of a square be 1, the circumference of a circle that will encompass that square will be 4,443. Therefore, as 1:4,443::15,98:70,99914, the circumference required.

*Problem 16.* Having the side of a square, to find the circumference of a circle that will be equal to it.

If the fide of a fquare be 1, the circumference of a circle that will be equal to it is 3,545. Then, as  $1 : 3,545 :: 20,0291 : 71,0031595$ , the circumference.

In feveral of the forgoing problems, where the diameter and circumference are required, the answers are not exactly the fame as the diameter and circumference of the given circle, but are fometimes too much, and fometimes too little, as in the two laft problems, where the answers in each fhould be 71, the one being too much, and the other too little. The reafon of this is, the fmall defect that happens to be in the decimal fractions, they being fometimes too great, and fometimes too little; yet the defect is fo fmall, that it is needlefs to calculate them to more exactnefs.

## PART VI.

*A collection of QUESTIONS fet down promiscuoufly, for the greater trial of the foregoing RULES.*

(<sup>1</sup>) **W**RITE down two millions, five hundred and two thoufand, two hundred and five.

(<sup>2</sup>) What is the value of 14 barrels of foap, at  $4\frac{1}{2}d.$  per lb. each barrel containing 254lb. *Ans.* £66:13:6.

(<sup>3</sup>) If 100l. principal gain 5l. intereft in 12 months—what principal will gain 20l. in 8 months? *Ans.* £600.

(<sup>4</sup>) What number is that from which, if the fquare of 14 be deducted, and to the remainder the fquare of 12 be added, the fum will be 250? *Ans.* 302.

(<sup>5</sup>) A and B trade together; A put in 320l. for 5 months, B 460l. for 3 months, and they gained 100l.—what muft each man receive?

*Ans.* A £53:13:9<sup>778</sup>/<sub>298</sub>, and B £46:6:2<sup>28</sup>/<sub>298</sub>.

(<sup>6</sup>) How many yards of cloth, at 17s. 6s. per yard, can I have for 13 cwt. 2 qrs. of wool, at 14d. per lb?

*Ans.* 100 yards, 3<sup>1</sup>/<sub>2</sub> qrs.

(<sup>7</sup>) What number added to the cube of 21, will make the fum equal to 113 times 147? *Ans.* 7350.

(<sup>8</sup>) If I buy 1000 ells of linen, Flemish, for 90l.—what may I fell it at per ell in London, to gain 10l. by the whole?

*Ans.* 3s. 4d. per ell.

(<sup>9</sup>) A

Q.

(9) A has 648 yards of cloth, at 14s. per yard, ready money, but in barter will have 16s. B has wine at 42l. per tun, ready money, the question is—how much wine must be given for the cloth, and what is the price of a tun of wine in barter? *Ans.* 48l. the tun; and 10 tun 3 bhd.

12 $\frac{3}{4}$  gal. of wine must be given for the cloth.

(10) A jeweller sold jewels to the value of 1200l. for which he received in part 876 French pistoles, at 16s. 6d. each—what sum remains unpaid? *Ans.* £477:6s.

(11) An oilman bought 417 cwt. 1 qr. 15 lb. gross weight of train oil, tare 20 lb. per 112 lb.—how many nett gallons were there, allowing 7 $\frac{1}{2}$  lb. to a gallon? *Ans.* 5120 gal.

(12) I bought threescore pieces of Holland for three times as many pounds, and sold them again for four times as much; but if they had cost me as much as I sold them for—what should I have sold them for to gain after the same rate? *Ans.* £320.

(13) What number taken from the square of 54, will leave 19 times 46? *Ans.* 2042.

(14) If I buy a yard of cloth for 14s. 6d. and sell it for 16s. 9d.—what do I gain per cent.? *Ans.* £15:10:4 $\frac{2}{4}$ .

(15) Bought 27 bags of ginger, each weighing gross 84 $\frac{3}{4}$  lb. tare 1 $\frac{3}{8}$  lb. per bag, trett 4 lb. per 104 lb.—what do they come to at 8 $\frac{1}{2}$  s. per lb. *Ans.* £76:13:2 $\frac{1}{2}$ .

(16) If  $\frac{2}{3}$  of an ounce avoirdupois cost  $\frac{7}{8}$  of a shilling—what will  $\frac{5}{6}$  of a lb. cost? *Ans.* 17s. 6d.

(17) If  $\frac{5}{6}$  of a gallon cost  $\frac{5}{8}$  of a £.—what will  $\frac{5}{9}$  of a tun cost? *Ans.* £105.

(18) A young man received 210l. which was  $\frac{2}{3}$  of his elder brother's portion; now three times the elder brother's portion was half of the father's estate—I demand how much the estate was? *Ans.* £1890.

(19) If the salary of an officer be 48l. per annum—what must he receive for 232 days? *Ans.* £30:10:2 $\frac{1}{4}$ .

(20) A gentleman spends one day with another 1l. 7s. 10 $\frac{1}{2}$  d. and at the year's end layeth up 340l.—what is his yearly income? *Ans.* £848:14:4 $\frac{1}{2}$ .

(21) A lady's fortune consisted of a cabinet worth 200l. containing 16 drawers, each having two partitions, each of which contained 37l. and two crowns—pray what was her portion? *Ans.* £1400.

(22) A has 13 fother of lead to send abroad, each being 19 $\frac{1}{2}$  times 112 lb.; B has 39 casks of tin, each 388 lb.—how



how many ounces difference is there in the weight of these commodities ?

*Ans.* 212160 oz.

(<sup>23</sup>) A Captain and 160 sailors took a prize worth 1360*l.* of which the Captain had  $\frac{1}{5}$  for his share, and the rest was equally divided among the sailors—what was each man's part ?

*Ans.* The Captain had 272*l.* and each sailor £6*l.* 16*s.*

(<sup>24</sup>) What number is that to which if you add  $7\frac{2}{3}$  the whole will be  $12\frac{1}{4}$  ?

*Ans.*  $1\frac{7}{12}$ .

(<sup>25</sup>) An usurer put out 75*l.* for 12 months, and received for principal and interest 81*l.*—I demand at what rate *per cent.* he received interest ?

*Ans.* 8 *per cent.*

(<sup>26</sup>) What will 956*l.* amount to in  $7\frac{1}{2}$  years, at 5 *per cent.* simple interest ?

*Ans.* £1314*l.* 10*s.*

(<sup>27</sup>) At what rate *per cent.* will 956*l.* amount to 1314*l.* 10*s.* in  $7\frac{1}{2}$  years at simple interest ?

*Ans.* 5 *per cent.*

(<sup>28</sup>) If for 1*l.* 4*s.* I have 1200*lb.* weight carried 36 miles—how many *lb.* weight can I have carried 24 miles for the same money ?

*Ans.* 1800*lb.*

(<sup>29</sup>) If 8 cannons in one day spend 48 barrels of powder, I demand how many barrels 24 cannons will spend in 22 days ?

*Ans.* 3168.

(<sup>30</sup>) What number is that which being multiplied by  $\frac{2}{3}$  will produce  $\frac{1}{4}$  ?

*Ans.*  $\frac{3}{8}$ .

(<sup>31</sup>) A has 24 kine worth 72*s.* each, and B 7 horses worth 13*l.* a piece—how much will make good the difference, in case they interchange their said drove of cattle ?

*Ans.* £4*l.* 12*s.*

(<sup>32</sup>) A man dies and leaves 120*l.* to be given to three persons, viz. A, B, and C; to A a share unknown; B twice as much as A, and C as much as A and B—what was the share of each ?

*Ans.* A £20; B £40; and C £60.

(<sup>33</sup>) A person dying left his widow 1780*l.* and 1250*l.* to each of his four children; he had been  $25\frac{1}{2}$  years in trade, and had cleared, at an average, 126*l.* a-year—what had he to begin with ?

*Ans.* £3567.

(<sup>34</sup>) There is a sum of 1000*l.* to be divided among three men in such manner, that if A has 3*l.* B shall have 5*l.* and C 8*l.*—how much must each man have ?

*Ans.* A £187*l.* 10*s.*; B £312*l.* 10*s.*; and C £500.

(<sup>35</sup>) A piece of wainscot is 8*ft.*  $6\frac{1}{2}$  *in.* long, and 2*ft.*  $9\frac{3}{4}$  *in.* broad—what is the superficial content ?

*Ans.* 24*ft.* 3*in.* 4*in.* 6*in.*

(<sup>36</sup>) How many changes may be rung on 6 bells ?

*Ans.* 720.

(<sup>37</sup>) A merchant at Amsterdam is indebted to another in

London 642*l.* and would pay it in Spanish guilders; at 2*s.* per piece—how many must the English merchant receive?

*Ans.* 6420.

(38) If 360 men be in garrison, and have provisions for 6 months, but hearing of no relief at the end of 5 months—how many men must depart, that the provisions may last as much longer?

*Ans.* 288 men.

(39) The less of two numbers is 187, their difference 34—the square of the product is required?

*Ans.* 1707920929.

(40) A butcher sends his man with 216*l.* to a fair to buy cattle; oxen at 11*l.* cows at 40*s.* colts at 1*l.* 5*s.* and hogs at 1*l.* 15*s.* per piece, and of each a like number—how many of each sort did he buy?

*Ans.* 13 of each sort, and 8*l.* over.

(41) What number added to  $11\frac{5}{7}$ , will produce  $36\frac{3}{8}\frac{7}{6}$ ?

*Ans.*  $24\frac{5}{8}\frac{13}{6}$ .

(42) What number multiplied by  $\frac{3}{7}$ , will produce  $11\frac{9}{17}$ ?

*Ans.*  $26\frac{4}{5}\frac{6}{17}$ .

(43) A man had 12 sons, the youngest was 3 years old and the eldest 58; they increased in Arithmetical Progression, what was the common difference of their ages?

*Ans.* 5 years.

(44) What is the value of 7179 hogheads of tobacco, each weighing 13 cwt. at 2*l.* 1*s.* per cwt.

*Ans.* £191320:7*s.*

(45) My factor sends me word he has bought goods to the value of 500*l.* 13*s.* 6*d.* upon my account, what will his commission come to at  $3\frac{1}{2}$  per cent.?

*Ans.* £17:10:5. 2 qrs.  $\frac{68}{100}$ .

(46) Miss Kitty told her sister Charlotte, whose father had before left them 13200*l.* a piece, that their grandmother by will had raised her fortune to 15000*l.* and had made her own 20000*l.*—what did the old lady leave them?

*Ans.* £8600.

(47) A snail in getting up a May-pole, only 20 feet high, was observed to climb 8 feet every day, but every night he came down again 4 feet—in what time, by this method, did he reach the top of the pole?

*Ans.* 4 days.

(48) If the  $\frac{1}{3}$  of 6 be 3—what will  $\frac{1}{4}$  of 20 be?

*Ans.*  $7\frac{1}{2}$ .

(49) What is the difference between 14676, and the fourth of itself?

*Ans.* 11007.

(50) There is in three bags, the sum of 1468*l.* viz. in the first bag 461*l.* in the second 581*l.* what was in the third bag?

*Ans.* £426.

(51) What is the decimal of 3 qrs. 14 lb. of a cwt.?

*Ans.* .875.

(52) How many lb. of sugar, at  $4\frac{1}{2}$ *d.* per lb. must be given in barter for 60 gross of inkle, at 8*s.* 8*d.* per gross?

*Ans.* 1386 $\frac{2}{3}$ .

(53) If I buy yarn at 9*d.* the lb. and sell it again for  $4d\frac{1}{2}$ —what is the loss per cent.?

*Ans.* £50.

(<sup>54</sup>) A tobacconist would mix 20lb. of tobacco at 9d. per lb. with 60lb. at 12d. per lb. 40lb. at 18d. per lb. with 12lb. at 2s. per lb.—what is a lb. of this mixture worth?

*Ans.* 1s. 2½d. 9⁄11.

(<sup>55</sup>) What is the value of 14 barrels of soap at 4½d. per lb. each barrel containing 254 lb.?

*Ans.* £66:13:6.

(<sup>56</sup>) Two persons, A and B, are indebted; the least debt being that of A's which is 2173l. their difference is 371l.—what is B's debt?

*Ans.* £2544.

(<sup>57</sup>) What is the difference between twice eight and twenty and twice twenty-eight: As also between twice five and fifty and twice fifty-five?

*Ans.* 20 and 50.

(<sup>58</sup>) What number taken from the square of 54 will leave 19 times 46?

*Ans.* 2042.

(<sup>59</sup>) A schoolmaster being asked how many scholars he had, said if I had as many more, half as many, and one quarter as many, I should have 99—how many had he?

*Ans.* 36.

(<sup>60</sup>) An ancient lady being asked how old she was, to avoid a direct answer, said, I have 9 children, and there are 3 years between the birth of each of them; the eldest was born when I was 19 years old, which is now exactly the age of the youngest—how old was the lady?

*Ans.* 62.

(<sup>61</sup>) What number is that which being added to 168 makes the sum to be 706?

*Ans.* 538.

(<sup>62</sup>) { From 100l. borrowed take 70l. paid;

{ 'Twas a virgin that lent it—what's due to the maid?

*Ans.* £30.

(<sup>63</sup>) If when the wheat is 4s. the bushel, the 20-penny loaf weighs 18lb.—what must the said 20-penny loaf weigh, when wheat is 6s. the bushel?

*Ans.* 12lb.

(<sup>64</sup>) { Whereas a noble and a mark just 15 yards did buy—

{ How many ells of the same cloth for 50l. had I? *Ans.* 600.

(<sup>65</sup>) A broker bought for his principal in the year 1720, 400l. capital stock in the South Sea, at 650l. per cent, and sold it again when it was worth but 130l. per cent—how much was lost in the whole?

*Ans.* £2080.

(<sup>66</sup>) What number added to the 43d part of 442, will make the sum 240?

*Ans.* 137.

(<sup>67</sup>) What number deducted from the 26th part of 2262 will leave the 87th part of the same.

*Ans.* 61.

(<sup>68</sup>) A gentleman went to sea at 17 years of age; 8 years after that he had a son born, who lived 46 years, and died before his father; after whom the father lived twice twenty years, and then died also—what was the age of the father when he died?

Q3

*Ans.* 111.



(69) C hath candles at 6s. per dozen, ready money, but in barter will have 6s. 6d. per dozen; D hath cotton at 9d. per lb. ready money—I demand what price the cotton must be at in barter; also how much cotton must be bartered for 100 dozen of candles? *Ans. the cotton at 9½d. per lb. and*

*7 cwt. 16lb. of cotton must be given for 100 doz. of candles.*

(70) The sum of two numbers is 360, the less 114—what is their difference, product, and quotient?

*Ans. 132 diff. 28044 prod. 2⅓ quotient.*

(71) A brigade of horse, consisting of 384 men, is to be formed into a square body, having 32 men in front—how many ranks will there be? *Ans. 12.*

(72) If a clerk's salary be 73l. a year—what is that per day? *Ans. 4s.*

(73) B hath an estate of 53l. per annum, and payeth 5s. 10d. to the subsidy—what must C pay, whose estate is worth 100l. per annum? *Ans. 11⅓s.*

(74) If I buy 100 yards of ribband at 3 yards for a shilling, and 100 more at 2 yards for a shilling, and sell it at the rate of 5 yards for 2 shillings, whether do I get or lose and how much? *Ans. lose 3s. 4d.*

(75) What is the value of  $\frac{5}{8}$  of 20s.? *Ans. 12s. 6d.*

(76) What number is that from which if you take  $\frac{3}{5}$ , the remainder will be  $\frac{1}{8}$ ? *Ans.  $\frac{29}{8}$ .*

(77) My purse and money, quoth Dick, are worth 12s. 8d. but the money is worth 7 of the purse—pray what is the sum therein? *Ans. 11s. 1d.*

(78) What number is that which maketh 9 to be the  $\frac{2}{3}$  of it? *Ans. 13½.*

(79) A maltster has several sorts of malt, one at 4s. 6d. one at 4s. and one at 3s. 6d. a bushel; to mix an equal quantity of each—what must be the price of a bushel? *Ans. 4s.*

(80) A farmer is willing to make a mixture of rye at 4s. a bushel, barley at 3s. and oats at 2s. how much must he take of each to sell it at 2s. 6d. the bushel?

*Ans. 6 of rye, 6 of barley, and 24 of oats.*

(81) If  $\frac{3}{8}$  of a ship be worth 3740l.—what is the worth of the whole? *Ans. £9973:6:8.*

(82) A person said he had 20 children, and that it happened there was a year and a half between each of their ages; his eldest son was born when he was 24 years old, and the age of his youngest is 21, what was the father's age? *Ans. 73½ years.*

(83) Bought a cask of wine for 62l. 8s.—how many gallons were in the same, when a gallon was 5s. 4d. *Ans. 234.*



(<sup>84</sup>) B owes C 296*l.* 17*s.* but he compounds for 7*s.* 6*d.* in the pound, what must C receive for his debt? *Ans.* £111:6:4 $\frac{1}{2}$ .

(<sup>85</sup>) How many dozen of stockings at 11 groats *per* pair, may I buy for 190*l.* 12*s.*? *Ans.* 86 *doz.* 7 *pair*  $\frac{23}{4}$ .

(<sup>86</sup>) A sheepfold was robbed three nights successively; the first night half the sheep were stolen and half a sheep more; the second night half the remainder were lost, and half a sheep more; the last night they took half that were left, and half a sheep more; by which time they were reduced to 20—how many were they at first? *Ans.* 167.

(<sup>87</sup>) The Spectator's club of fat people, though it consisted but of 15 persons, is said to weigh no less than 3 tons, how much at an equality was that *per* man? *Ans.* 4 *cwt.*

(<sup>88</sup>) A merry young fellow in a short time got the better of  $\frac{1}{5}$  of his fortune; by advice of his friends he gave 2200*l.* for an exempt's place in the guards; his profusion continued till he had no more than 880 guineas left, which he found by a computation was the  $\frac{3}{10}$  part of his money after the commission was bought—pray what was his fortune at first? *Ans.* £10450

(<sup>89</sup>) B owes C 395*l.* 18*s.* but compounds the whole debt for 100*l.* 12*s.*—what is that in the pound?

*Ans.* 5*s.* 0 $\frac{3}{4}$ *d.*  $\frac{7446}{918}$ .

(<sup>90</sup>) How many dollars at 4*s.* 4*d.* each must be given for 360 guilders, at 2*s.* 2*d.* each? *Ans.* 180.

(<sup>91</sup>) Four men have a sum of money to be divided amongst them, in such a manner that the first shall have  $\frac{1}{3}$  of it, the second  $\frac{1}{4}$ , the third  $\frac{1}{6}$ , and the fourth the remainder, which is 28*l.*—what is the sum? *Ans.* £112.

(<sup>92</sup>) What is the amount of 1000*l.* for 5 $\frac{1}{2}$  years, at 4 $\frac{3}{4}$  *per cent.* simple interest? *Ans.* £1261:5*s.*

(<sup>93</sup>) Sold goods amounting to the value of 700*l.* for two 4-months—what is the present worth at 5 *per cent.* simple interest? *Ans.* £682:19:4 $\frac{3}{4}$  +.

(<sup>94</sup>) A room 30 feet long, and 18 feet wide, is to be covered with painted cloth—how many yards of  $\frac{3}{4}$  wide will cover it? *Ans.* 80 *yards.*

(<sup>95</sup>) There are two numbers, the one 48, the other twice as much—what is the difference between their sum and difference? *Ans.* 96.

(<sup>96</sup>) Hetty told her brother George, that though her fortune on her marriage took 19312*l.* out of her family, it was but  $\frac{2}{3}$  of two years rent, Heaven be praised! of his yearly income—pray what was that? *Ans.* £16093:6:8 a-year.

(97) There are two numbers, the one 25, the other the square of 25—I demand the square root of the sum of their squares?

*Ans.* 625, 4998.

(98) Says B to C, if I had four of your sheep, I should have as many as you; and says C to B, if I had four of yours, I should have twice as many as you—how many had each?

*Ans.* B 20, C 28.

(99) B, C, and D, trading together, gained 120*l.* which is to be shared according to each man's stock; B put in 140*l.* C 300*l.* and D 160*l.*—what is each man's share?

*Ans.* B £28; C £60; D £32.

(100) A gentleman having 50*s.* to pay among his labourers for a day's work would give to every boy 6*d.* to every woman 8*d.* and to every man 16*d.* the number of boys, women, and men were the same—I demand the number of each?

*Ans.* 20 of each.

(101) There are three numbers 17, 19, and 48—I demand the difference between the sum of the squares of the first and last, and the cube of the middlemost?

*Ans.* 4266.

(102) A stone that measures 4 feet 6 inches long, 2 feet 9 inches broad, and 3 feet 4 inches deep—how many solid feet doth it contain?

*Ans.* 41 feet, 3 inches.

(103) What does the whole pay of a man of war's crew of 640 sailors amount to for 32 months' service, each man's pay being 22*s.* 6*d.* per month?

*Ans.* £23040.

(104) If I have an estate of 470*l.* per ann.—what may I expend daily, and yet lay up 130*l.* per ann.

*Ans.* 18*s.* 7½*d.*  $\frac{90}{365}$ .

(105) What number is that, which being divided by 19, the quotient will be 72?

*Ans.* 1368.

(106) Reduce 13½ bushels of coals to the fraction of a chaldron?

*facit*  $\frac{3}{8}$ .

(107) Bought 28 qrs. 2 bushels of wheat at 4*s.* 6*d.* per bushel what does it come to?

*Ans.* £50:17.

(108) How many lbs. of coffee, at 5*s.* 9*d.* per lb. is equal in value to 426*lb.* of tea, at 13*s.* 4*d.* per lb.?

*Ans.* 987½*lb.*

(109) What is the value of 27 dozen 10*lb.* of candles, at 5*d.* per lb.?

*Ans.* £6:19:2.

(110) A traveller would exchange 500 French crowns, at 4*s.* 6*d.* per crown into sterling money, but he must pay a halfpenny per crown for change—how much must he receive?

*Ans.* £111:9:2.

(111) There are two numbers, the one 63, and the other

other  $\frac{1}{2}$  as much—I demand the product of their squares, and the difference of their product and sum?

*Ans. Product of their squares 3938240, 25, difference 1890.*

(<sup>112</sup>) B and C traded together, and gained 100*l.* B put in 64*l.* C put in so much that he might receive 60*l.* of the gain—I demand how much C put in?

*Ans. £960.*

(<sup>113</sup>) Of what principal sum did 20*l.* interest arise in one year, at the rate of 5 per cent. per annum?

*Ans. £400.*

(<sup>114</sup>) Having bought 40 yards of cloth, at 8*s.* per yard, and 70 yards at 12*s.* what is the value of both pieces?

*Ans. £58.*

(<sup>115</sup>) Two men depart both from one place, the one goes north, the other south; the one goes 7 miles, and the other 11 miles a-day—how far are they distant at the 12th day of their departure?

*Ans. 216 miles.*

(<sup>116</sup>) In 672 Spanish guilders of 2*s.* each—how many French pistoles, at 17*s.* 6*d.* per piece?

*Ans. 76 $\frac{2}{3}$ .*

(<sup>117</sup>) In 7 cheefes, each weighing 1 cwt. 2 qrs. 5 lb.—how many allowances for seamen may be cut, each weighing 5 oz. 7 dr.?

*Ans. 356 $\frac{3}{4}$ .*

(<sup>118</sup>) If 48 taken from 120 leaves 72, and 72 taken from 91 leaves 19, and 7 taken from thence leaves 12—what number is that out of which when you have taken 48, 72, 19, and 7, leaves 12?

*Ans. 158.*

(<sup>119</sup>) A farmer, ignorant in numbers, ordered 500*l.* to be divided among his 5 sons, thus: Give A, says he,  $\frac{1}{3}$ . B  $\frac{1}{4}$ , C  $\frac{1}{5}$ , D  $\frac{1}{6}$ , and E  $\frac{1}{7}$  part; divide this equitably among them, according to the father's intention.

*Ans. A £152 $\frac{1}{3}$  2 $\frac{2}{3}$ ;*

*B £114 $\frac{1}{2}$  4 $\frac{1}{4}$ ; C £91 $\frac{1}{2}$  8 $\frac{1}{4}$ ; D £76 $\frac{1}{2}$  9 $\frac{1}{4}$ ; E £65 $\frac{1}{2}$  9 $\frac{1}{4}$ .*

120 { When first the marriage knot was ty'd between my wife and me,  
Her age did mine as far exceed as three times three does three;  
But when 7 years, and half 7 years, we man and wife had been,  
My age came then as near to her's as eight is to sixteen.

*Quest.* What was each of our ages when married?

*Ans. 10 $\frac{1}{2}$  years the man, 31 $\frac{1}{2}$  the woman.*

(<sup>121</sup>) If 12 oxen will eat 3 $\frac{1}{2}$  acres of grafs in 4 weeks, and 21 oxen will eat 10 acres in 9 weeks—how many oxen will eat 24 acres in 18 weeks, the grafs being allowed to grow uniformly?

*Ans. 36.*

(<sup>122</sup>) A lady was asked her age, who replied thus—

My age, if multiplied by three,

Two-sevenths of that product tripled be,

The square root of two-ninths of that is four—

Now tell my age, or never see me more.

*Ans. 28 years.*

TABLE for finding the Interest of any Sum of Money for any Number of Months, Weeks, or Days, at any Rate per cent.

Year.	Calend. Months				Weeks.			Days.		
£.	£.	s.	d.	£.	s.	d.	£.	s.	d.	
1	... 0	1	8	.. 0	0	4 $\frac{1}{2}$	0	0	0 $\frac{1}{2}$	
2	... 0	3	4	.. 0	0	9	0	0	1 $\frac{1}{4}$	
3	... 0	5	0	.. 0	1	1 $\frac{1}{4}$	0	0	2	
4	... 0	6	8	.. 0	1	6 $\frac{1}{2}$	0	0	2 $\frac{1}{2}$	
5	... 0	8	4	.. 0	1	11	0	0	3 $\frac{1}{4}$	
6	... 0	10	0	.. 0	2	3 $\frac{1}{4}$	0	0	4	
7	... 0	11	8	.. 0	2	8 $\frac{1}{4}$	0	0	4 $\frac{1}{2}$	
8	... 0	13	4	.. 0	3	1	0	0	5 $\frac{1}{4}$	
9	... 0	15	0	.. 0	3	5 $\frac{1}{2}$	0	0	6	
10	... 0	16	8	.. 0	3	10 $\frac{1}{4}$	0	0	6 $\frac{1}{2}$	
20	... 1	13	4	.. 0	7	8 $\frac{1}{4}$	0	1	1 $\frac{1}{4}$	
30	... 2	10	0	.. 0	11	6 $\frac{1}{2}$	0	1	7 $\frac{3}{4}$	
40	... 3	6	8	.. 0	15	4 $\frac{1}{2}$	0	2	2 $\frac{1}{4}$	
50	... 4	3	4	.. 0	19	2 $\frac{3}{4}$	0	2	9	
60	... 5	0	0	.. 1	3	1	0	3	3 $\frac{1}{2}$	
70	... 5	16	8	.. 1	6	11	0	3	10	
80	... 6	13	4	.. 1	10	9 $\frac{1}{2}$	0	4	4 $\frac{1}{2}$	
90	... 7	10	0	.. 1	14	7 $\frac{1}{4}$	0	4	11 $\frac{1}{4}$	
100	... 8	6	8	.. 1	18	5 $\frac{1}{4}$	0	5	5 $\frac{3}{4}$	
200	.. 16	13	4	.. 3	16	11	0	10	11 $\frac{1}{2}$	
300	.. 25	0	0	.. 5	15	4 $\frac{1}{2}$	0	16	5 $\frac{1}{4}$	
400	.. 33	6	8	.. 7	13	10	1	1	11	
500	.. 41	13	4	.. 9	12	3 $\frac{1}{2}$	1	7	4 $\frac{3}{4}$	
600	.. 50	0	0	.. 11	10	9	1	12	10 $\frac{1}{2}$	
700	.. 58	6	8	.. 13	9	2 $\frac{1}{4}$	1	18	4 $\frac{1}{4}$	
800	.. 66	13	4	.. 15	7	8 $\frac{1}{4}$	2	3	10	
900	.. 75	0	0	.. 17	6	1 $\frac{3}{4}$	2	9	3 $\frac{3}{4}$	
1000	.. 83	6	8	.. 19	4	7 $\frac{1}{4}$	2	14	9 $\frac{1}{2}$	
2000	.. 166	13	4	.. 38	9	2 $\frac{3}{4}$	5	9	7	
3000	.. 250	0	0	.. 57	13	10	8	4	4 $\frac{1}{2}$	
4000	.. 333	6	8	.. 76	18	5 $\frac{1}{2}$	10	19	2	
5000	.. 416	13	4	.. 96	3	0 $\frac{1}{4}$	13	13	11 $\frac{1}{2}$	
6000	.. 500	0	0	.. 115	7	8 $\frac{1}{4}$	16	8	9	
7000	.. 583	6	8	.. 134	12	3 $\frac{1}{2}$	19	3	6 $\frac{1}{2}$	
8000	.. 666	13	4	.. 153	16	11	21	18	4 $\frac{1}{4}$	
9000	.. 750	0	0	.. 173	1	6 $\frac{1}{4}$	24	13	1 $\frac{3}{4}$	
10,000	.. 833	6	8	.. 192	6	1 $\frac{3}{4}$	27	7	11 $\frac{1}{4}$	
20,000	.. 1666	13	4	.. 384	12	3 $\frac{1}{2}$	54	15	10 $\frac{1}{2}$	
30,000	.. 2500	0	0	.. 576	18	5 $\frac{1}{2}$	82	3	10	

RULE. Multiply the principal by the rate per cent. and the number of months, weeks, or days, which are required; cut off two figures on the right-hand side of the product, and collect from the table the several sums against the different numbers as when added will make the number remaining. Add the several sums together, it will give the interest required.

N. B. For every 10 that is cut off in months, add 2d.; for every 10 cut off in weeks, add an  $\frac{1}{4}$ d.; and for every 40 in the days,  $\frac{1}{4}$ d.



## EXAMPLES.

(1) What is the interest of 2467*l.* 10*s.* for 10 months, at 4 per cent. *per annum*?

$$\begin{array}{r} 2467 \text{ } 10 \\ 4 \\ \hline 9870 \text{ } 0 \\ 10 \\ \hline \end{array}$$

$$\begin{array}{r} 900 = 75 \text{ } 0 \text{ } 0 \\ 80 = 6 \text{ } 13 \text{ } 4 \\ 7 = 0 \text{ } 11 \text{ } 8 \\ \hline 987 = 82 \text{ } 5 \text{ } 0 \end{array}$$

$$987|00 \text{ } 0$$

(2) What is the interest of 2467*l.* 10*s.* for 12 weeks, at 5 per cent.?

$$\begin{array}{r} 2467 \text{ } 10 \\ 5 \\ \hline 12337 \text{ } 10 \\ 12 \\ \hline \end{array}$$

$$\begin{array}{r} 1000 = 19 \text{ } 4 \text{ } 7\frac{1}{4} \\ 400 = 7 \text{ } 13 \text{ } 10 \\ 80 = 1 \text{ } 10 \text{ } 9\frac{1}{4} \\ 50 = 0 \text{ } 0 \text{ } 2\frac{1}{4} \\ \hline \end{array}$$

$$1480|50 \text{ } 0$$

$$1480|50 = 28 \text{ } 9 \text{ } 4\frac{1}{4}$$

(3) What is the interest of 2467*l.* 10*s.* for 50 days, at 6 per cent.?

$$\begin{array}{r} 2467 \text{ } 10 \\ 6 \\ \hline 14805 \text{ } 0 \\ 50 \\ \hline \end{array}$$

$$\begin{array}{r} 7000 = 19 \text{ } 3 \text{ } 6\frac{1}{2} \\ 400 = 1 \text{ } 1 \text{ } 11 \\ 2 = 0 \text{ } 0 \text{ } 1\frac{1}{4} \\ 50 = 0 \text{ } 0 \text{ } 0\frac{1}{4} \\ \hline \end{array}$$

$$7402|50 \text{ } 0$$

$$7402|50 = 20 \text{ } 5 \text{ } 7$$

2. To find what an estate, from 1 to 60,000*l.* *per ann.* will come to for 1 day.

RULE. Collect the annual rent or income from the table of one year, against which take the several sums for one day, add them together, it will give the answer.

(4) An estate of 376*l.* *per annum*, what is that *per day*?

$$\begin{array}{r} 300 = 0 \text{ } 16 \text{ } 5\frac{1}{4} \\ 70 = 0 \text{ } 3 \text{ } 10 \\ 6 = 0 \text{ } 0 \text{ } 4 \\ \hline \end{array}$$

$$376 = 1 \text{ } 0 \text{ } 7\frac{1}{4}$$

3. To find the amount of any income, salary, or servants' wages, for any number of months, weeks, or days.

RULE. Multiply the yearly income, or salary, by the number of months, weeks, or days, and collect the product from the table.

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(\*) What will 270*l.* per annum come to for 11 months, for 3 weeks, and for 6 days?

For 11 months.

£.	£.	s.	d.
270	2000=166	13	4
11	900=75	0	0
	70=5	16	8
<hr/>			
2970	=247	10	0

For 3 weeks.

£.	s.	d.
800=15	7	8 $\frac{1}{4}$
10=0	3	10 $\frac{1}{4}$
<hr/>		
=15	11	6 $\frac{1}{2}$

For 6 days.

£.	£.	s.	d.
270	1000=2	14	9 $\frac{1}{2}$
6	600=1	12	10 $\frac{1}{2}$
	20=0	1	1 $\frac{1}{4}$
<hr/>			
1620	=4	8	9 $\frac{1}{4}$

For the whole time.

£.	s.	d.
247	10	0
15	11	6 $\frac{1}{2}$
4	8	9 $\frac{1}{4}$
<hr/>		
267	10	3 $\frac{3}{4}$

Ans.

A TABLE, showing the number of days from any day in the month to the same day in any other month through the year.

To	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
From Jan.	365	31	59	90	120	151	181	212	243	273	304	334
Feb.	334	365	28	59	89	120	150	181	217	242	273	303
Mar.	306	337	365	31	61	92	122	153	184	214	245	275
April	275	306	334	365	30	61	91	122	153	183	214	244
May	245	276	304	335	365	31	61	92	123	153	184	218
June	214	245	273	304	334	365	30	61	91	122	153	183
July	184	215	243	274	304	335	365	31	62	92	123	153
Aug.	153	184	212	243	273	304	334	365	31	61	92	122
Sep.	122	153	181	212	242	273	303	334	365	30	61	91
Oct.	92	123	151	182	212	243	273	304	335	365	31	61
Nov.	61	92	120	151	181	212	243	273	304	334	365	30
Dec.	31	62	90	121	151	182	212	243	274	304	335	365

THE END.



